Books/Book Chapters/Conference Papers 2018-19

SI No.	Name of the Teacher	Title of the Paper/Books/Book Chapter	Title of the proceedings of the conference	Name of the conference	National/ International	Year of publication	ISBN/ISSN number of the proceeding	Affliating Institute at the time of publication	Name of the Publisher
1	Dr.B.Krishna Kumar	TEXT BOOK ON "Estimation of Statistical Parameters of EEG Signals Using Wavelets"			International	Aug/19	ISBN 978-3-659-53952-7	MCET,Abids,Hyderadad	LONDON ACADEMY OF PUBLISHING
2	Dr Vuppu Padmakar	C Programming				07/Sep/18	ISBN 978-81-938585-3-0	Methodist College of Engg and Tech., Hyd	Methodist College of Engg and Tech., Hyd
3	Dr Vuppu Padmakar	Object Oriented Programming Using C++				07/Sep/18	ISBN 978-81-938585-4-7	Methodist College of Engg and Tech., Hyd	Methodist College of Engg and Tech., Hyd
4	Hira Singh and Raghu Chandra Garimella	Recent Trends and Innovations in Modern Engineering TLBO Algorithm based Optimized PID controller to Analyse Small Hydropower Plant			International	Jul/18	ISBN: 978-81-936117-6-0	Madanapalle Institute of Technology and Science	Academica Press
5	Garimella Raghu Chandra and Vedala Rama Sastry	Learning and Analytics in Intelligent Systems Extraction of Electricity from Blast induced Ground Vibration Waves – Case Study			International	22-23 March 2019	ISSN: 2662-3447	Methodist College of Engineering and Technology	Springer
6	Raghu Chandra Garimella, Rajasekhar Ballari and Rama Sastry Vedala	Proceedings of Applied Sciences and Engineering Estimation of burden rock movement with the energy distribution – case study		Civil Engineering Trends and Challenges for Sustainability (CTCS 2019)	International	23-24 MAY 2019	ISSN: 2523-3971	Methodist College of Engineering and Technology	Springer
7	M.Madhuri,P.Sai Shraddha	Optimally locating rain water harvesting pits using GIS as tool		Recent advances in civil engineering	national	28/Jun/19		JNTU-H	
8	P.Sai shraddha, M.Madhuri	Comparative study on acid resistance of geopolymer concrete to conventinal concrete		Recent advances in civil engineering	national	28/Jun/19		JNTU-H	

PRINCIPAL
METHODIST COLLEGE OF ENGG. & TECH.
King Koti Road, Abids, Hyderabad

Books/Book Chapters/Conference Papers 2018-19

SI No.	Name of the Teacher	Title of the Paper/Books/Book Chapter	Title of the proceedings of the conference	Name of the conference	National/ International	Year of publication	ISBN/ISSN number of the proceeding	Affliating Institute at the time of publication	Name of the Publisher
9	Swetha.R,Md Asadullah,Md Yunus,shobab.A	Thermal analysis of tbc coated superalloy for industrial gas turbine applications	Proceedings of the Int.Conf. on Paradigms in Engg and Tech. (ICPET-2018)	International Conference on Paradigms in Engineering and technology (ICPET 2018).	International	28-29 December 2018	ISSN (Online): 2395-5295	MCET	
10	Y Madhu Maheswara Reddy, M Prasad	Design And Analysis Of Light Weight Foldable Cycle With Honey Comb Structure		2nd Int.Conf. on Paradigms in Engg and Tech. (ICPET-2018)	International	28-29 December 2018	ISSN (Online): 2395-5295	Methodist College of Engg and Tech., Hyd	Methodist College of Engg and Tech., Hyd
11	M.Bal, M. Purnima, Dr. B. Naik, and Dr. S. N.Sahoo	Effect of land use and runoff characteristics in Rourkela city using SWMM5.1	Hydro-2018 International	23rd International Conference on Hydraulics, Water Resources and River Engineering	International	19-21 December 2018		NIT Patna	
12	Swagatika Biswal, Dr. Bandita Naik, and Dr. K. K. Khatua	Rainfall Runoff Studies Of Brahmani River Basin Using Ann	Hydro-2018 International	23rd International Conference on Hydraulics, Water Resources and River Engineering	International	19-21 December 2018		NIT Patna	
13	Arunima priyadarsini patnaik, and Dr. Bandita Naik	Impact of Climate Change on Hydrological Parameters	Hydro-2018 International	24th International Conference on Hydraulics, Water Resources and River Engineering	International	19-21 December 2018		NIT Patna	
14	S. Behera, K. Rout, and B. Naik	Loss coefficient for Contraction in Converging Channel	Hydro-2018 International	25th International Conference on Hydraulics, Water Resources and River Engineering	International	19-21 December 2018		NIT Patna	
15	M.MAHESH BABU	Analytical Approach of Trivium FPGA Implementations against Information Security Vulnerability	INTERNATIONAL CONFERENCE ON PARADIGMS IN ENGINEERING AND TECHNOLOGY	International Conference on Paradigms in Engineering and technology (ICPET 2018).	INTERNATIONAL	28-29 December 2018		MCET	
16	Y. Mastanamma, Dr. D. Subbarayudu	Performance Analysis of Sliding Mode Controller fed PMSG based Wind Energy Conversion System	ICPET-2018	2nd International Conference on Paradigms in Engineering & Technology	International	28-29 December 2018		Osmania University	Methodist College of Engineering and Technology

PRINCIPAL
METHODIST COLLEGE OF ENGG. & TECH.
King Koti Road, Abids, Hyderabad.

Books/Book Chapters/Conference Papers 2018-19

SI No.	Name of the Teacher	Title of the Paper/Books/Book Chapter	Title of the proceedings of the conference	Name of the conference	National/ International	Year of publication	ISBN/ISSN number of the proceeding	Affliating Institute at the time of publication	Name of the Publisher
17	Dr.K.Anuradha Reddy	Electrical Propeties of Polyvinyl Alcohol Doped with kaolin	INTERNATIONAL CONFERENCE ON PARADIGMS IN ENGINEERING AND TECHNOLOGYICPET2018	INTERNATIONAL CONFERENCE ON PARADIGMS IN ENGINEERING AND TECHNOLOGYICPET2018	International	28-29 December 2018	ISSN (Online): 2395-5295		

PRINCIPAL
METHODIST COLLEGE OF ENGG. & TECH.
King Koti Road, Abids, Hyderabad.

The Electroencephalogram (EEG) is the standard technique for investigating the brains electrical activity in different psychological and pathological states. Analysis of Electroencephalogram (EEG) signal is a challenging task due to the presence of different artifacts such as Ocular Artifacts (OA) and Electromyogram. Normally EEG signals falls in the frequency range of DC to 60 Hz and amplitude of 1-5 μv. Ocular artifacts do have the similar statistical properties of EEG signals, often interfere with EEG signal, thereby making the analysis of EEG signals more complex. In this book, Iterative soft thresholding technique was employed by using different wavelet functions, in the removal of ocular artifacts (OA) present in the EEG signal and estimated the statistical parameters of the EEG signal.

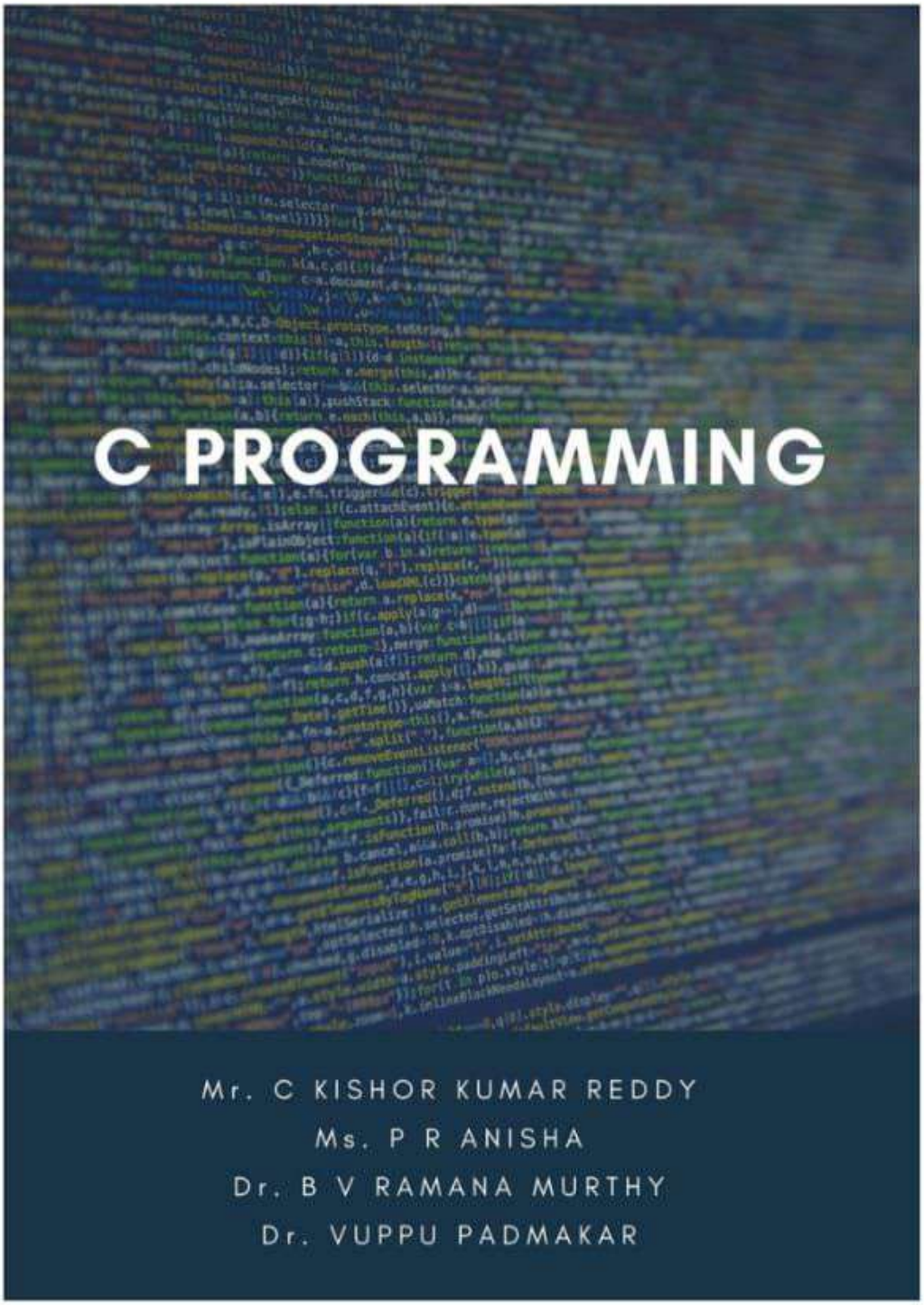
B. Krishna Kumar holds a Ph.D. degree in Electronics and Communication Engineering from Jawaharlal Nehru Technological University, Hyderabad, INDIA (2016). He also has a M.Tech degree in Digital Systems and Computer Electronics from Jawaharlal Nehru Technological University, Hyderabad, INDIA.

978-3-659-53952-7

B. Krishna Kumar

Estimation of Statistical Parameters of EEG Signals Using Wavelets

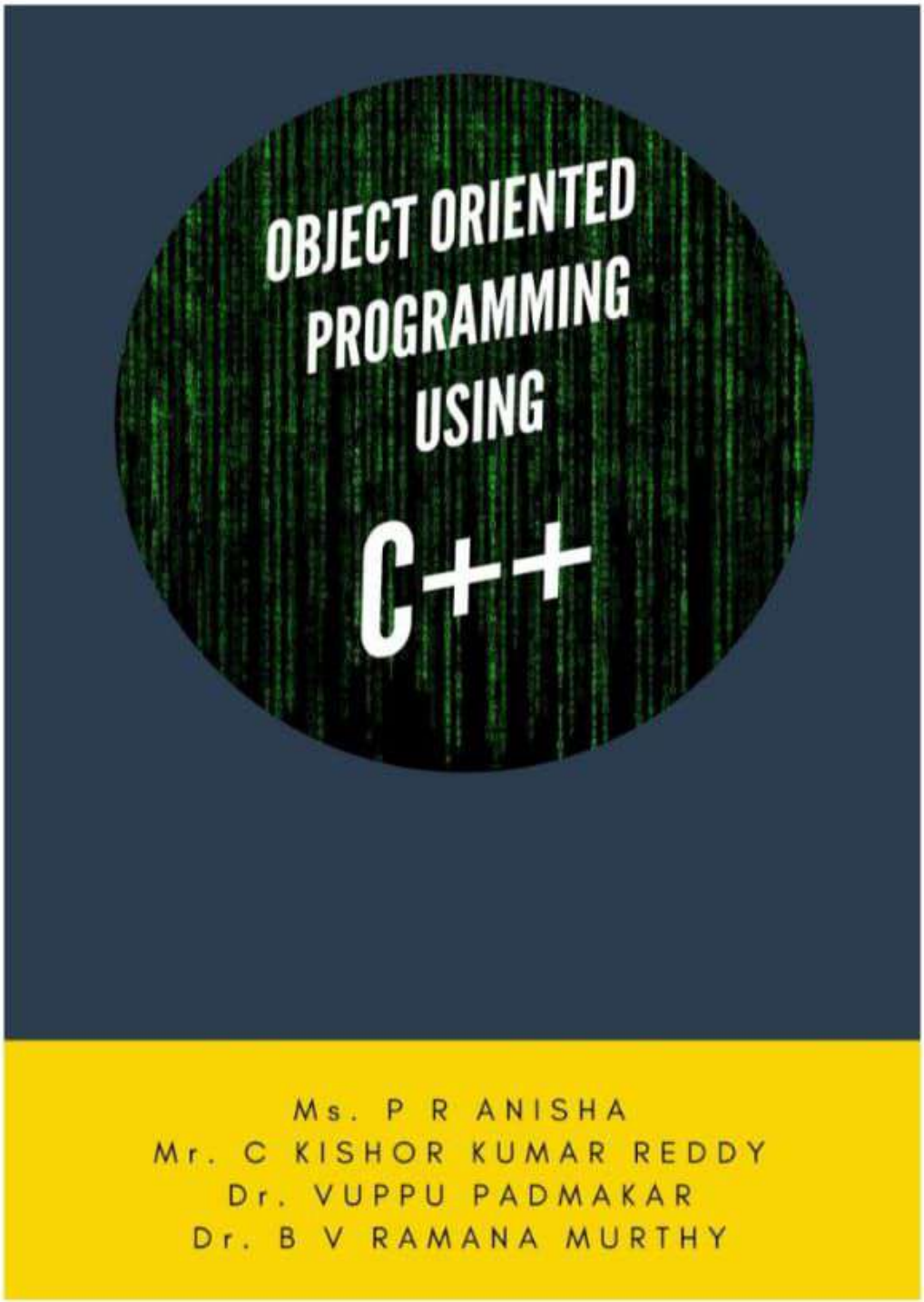
LAP LAMBERT Academic Publishing



Author: C Kishor Kumar Reddy, P R Anisha, B V Ramana Murthy, Vuppu Padmakar

Language: English

ISBN: 9788193858530



Author: C Kishor Kumar Reddy, P R Anisha, B V Ramana Murthy, Vuppu Padmakar

Language: English

ISBN: 9788193858547

Application of TLBO Algorithm Optimized PID Controller to Analyse Small Hydropower Plant

[1]Hira Singh Sachdev and [2]Raghu Chandra Garimella

[1]Sr. Assistant Professor, Department of Electrical and Electronics Engineering, Madanapalle Institute of Technology and Science, Andhra Pradesh
singhhira10@gmail.com

[2]Associate Professor, Department of Electrical and Electronics Engineering, Methodist College of Engineering and Technology, Telangana
raghuchandhra@india.com

Abstract. The issues of climatic change and raise in load demand day by day has led to the search of alternative sources which are renewable, economic as well as eco-friendly in nature. Small hydropower has become a better option to modify the energy scenario of the world and India. This paper is an approach to design off-grid and grid connected model of small hydropower plant in MATLAB/SIMULINK. The PID and FOPID controllers are used and the result is compared for both. TBLO and ATBLO algorithm is adopted to optimize PID parameters value to maximize output power and so as to get synchronised with the system and to enhance the response of the system. In this paper, the proposed TBLO and ATBLO optimized PID controller and FOPID controller is used. The islanding operation of SHP is performed to analysis the transient behaviour of the system.

Keywords: Small Hydro Power Plant (SHP), Proportional-Integral-Derivative (PID) controller, Teaching-Based Learning Optimisation (TBLO) algorithm, Renewable Energy Resources (RES).

p. 65-75

Full article in PDF |

ISBN: 978-81-936117-6-0

Application of TLBO Algorithm Optimized PID Controller to Analyse Small Hydropower Plant

Hira Singh Sachdev[1] and Raghu Chandra Garimella[2]
[1]Sr. Assistant Professor, Department of Electrical and Electronics Engineering,
Madanapalle Institute of Technology and Science, Andhra Pradesh
singhhira10@gmail.com
[2]Associate Professor, Department of Electrical and Electronics Engineering,
Methodist College of Engineering and Technology, Telangana
raghuchandhra@india.com

Abstract: The issues of climatic change and raise in load demand day by day has led to the search of alternative sources which are renewable, economic as well as eco-friendly in nature. Small hydropower has become a better option to modify the energy scenario of the world and India. This paper is an approach to design off-grid and grid connected model of small hydropower plant in MATLAB/SIMULINK. The PID and FOPID controllers are used and the result is compared for both. TBLO and ATBLO algorithm is adopted to optimize PID parameters value to maximize output power and so as to get synchronised with the system and to enhance the response of the system. In this paper, the proposed TBLO and ATBLO optimized PID controller and FOPID controller is used. The islanding operation of SHP is performed to analysis the transient behaviour of the system.

Keywords: Small Hydro Power Plant (SHP), Proportional-Integral-Derivative (PID) controller, Teaching-Based Learning Optimisation (TBLO) algorithm,

Renewable Energy Resources (RES).

Introduction

In the present scenario, renewable energy source plays an important role to meet the fast-growing load demand. The increasing overuse of renewable energy technologies worldwide because of global warming and decreasing supply of fossil fuels[1]. Renewable energy is now coming in world focus. Researchers consider RES as promising energy sources. Some countries have more than one renewable energy resource and therefore have made policies to increase the utilisation of RES for the electrical power generation [1]. However the efforts for generating electricity are faced with several challenges including availability of certain power source to cover demand, power fluctuation, and power quality. Thus by combining more than one renewable energy source into a system can overcome the problem of power availability to meet demand in certain times [2].

Considering the global concerns for RES, many countries have started on the mission to reduce greenhouse gas emissions by increasing the part of renewable energy in their total energy matrix [3]. Hydropower is not only a sustainable and renewable source of energy but it is highly flexible and its storage capacity helps in improving stability of grid and supports disposition of other discontinuous renewable energy sources like wind and solar power[4]. Many renewable energy are not presently economically viable for some developing countries[5]. Small hydro power plants, solar and wind energy system helps in meeting the objectives of climate change. The run-of the- river (ROR) hydroelectricity is free from carbon dioxide or other greenhouse gas emissions and is an environmental friendly technology. In hydroelectric plant has a hydro turbine with a non-linear, non-stationary multivariable system which means its characteristics differ much with the uncertain load over it and which causes a problem in designing an efficiently reliable controller[6]. Furthermore, hydropower plants have profitable benefit for the plant operator. Although, the investment in the construction of plant is high, there is low operating cost which urges high efficiency in cost. Hence, with less installed power, there is a decrease in cost efficiency for small

hydro power plant[7]. The large-scale hydro power generation is affected by site location, capital costs, location of dams, lengthy development time etc. However, these problems are solved by Small Hydro Power (SHP) developments[5].

Literature Survey

The literature survey has been made for this proposed work is through various IEEE journals, science direct journals, research papers, books, relevant websites, technical notes etc. In the literature survey, the power system stability and control and its basics have been described in [7], [8]. The various types of excitation system, their various component and composition are discussed by Lee et al. [9]. K. Kimet.al [10], proposed a technique to tune PID controller for excitation system. L. Tenorio[11] has discussed the different type of model for hydraulic-turbine, their components and their control, and also specific model of hydraulic turbine and governor used for hydropower plant. The detailed survey on the development analysis has been evaluated in [12], [13]. The Small hydropower plant application and its advantages are focused in [14]. Here the different algorithms are used and the simulation Result and discussion is done and finally the conclusion has been discussed in this proposed work.

System description

To study the dynamic response of the system, it is important to model the power system accurately. Hydraulic turbine, excitation system and its governor system can affect the power system performance so its modelling can help in studying the dynamic response of the system. The elemental block diagram of a Hydraulic-Turbine governor system is shown in Fig. 1. The complete model of the proposed work is divided into several small modules shown in Fig. 1; they are speed governor, hydraulic turbine, generator, excitation system etc. Linear model of hydropower system is useful for studying tuning of control system by applying linear analysis tools (frequency response, eigen value etc.) but cannot be used for the studies related to large power output and frequency variation. The

shortcomings of linear model are rectified by nonlinear model assuming an elastic or non-elastic water column which is mostly used under the condition of large power output and frequency fluctuation. Regarding simulation of dynamic characteristic or response of hydraulic turbine, the model based on operation curves and parameter recognition for characteristics of hydraulic turbine is preferred more apart from that the characteristic and operation curves are difficult to obtain [15].

Controller

In hydroelectric system many equipment connected are sensitive to frequency variation. So, we need to control the speed of the system. Regulating the amount of water entering the turbine runner is a conventional method of regulating and maintaining constant speed to drive the generator and for regulating the power output[16]. The governor finds the error in speed between actual and desired values which cause changes in the turbine output. It is performed so that the system load comes into equilibrium with the output of generating unit at the desired speed [17]. To improve the system stability and to minimize the overshoot and undershoot the controllers are used to minimize the steady state error to zero or near to zero, we can use different controller such as P, PI, PID, and fuzzy logic controller. In our proposed work, controller is deployed at two different subsystems one is at speed governor and another is at excitation system. It is previously declared in above section, our proposed work deals with the PID controller and the hybrid Fuzzy PI controller. The PID controller assists in maintaining the stability of the isolated system. It is helps in bringing the speed or frequency and the voltage phasor nearer to their reference value, thus aids the synchronization process. The PID controller enhances the transient response and thus reduces the error amplitude with each oscillation and then output is ultimately settles to a final desired value. Thus during a transient response, for hydro turbine application, the system frequency is controlled within 48Hz-53Hz limit, otherwise the over or under-frequency protection will trigger and trip off

the Distribution Generation and stop the Distribution Generation's operation so as to prevent the chance of out of phase recloser[16]. PID controllers give better stability margin [17].

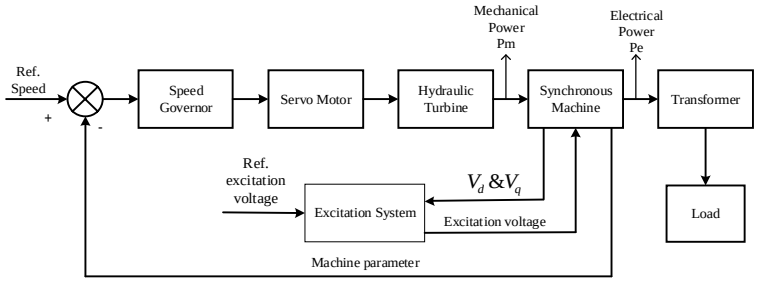


Fig. 1 Block diagram of Hydraulic governor-turbine system

PID Controller

A PID controller (Proportional-Integral-Derivative controller) measures the error between a measured variable and a desired reference value. It tries to reduce the error by adjusting the controller parameters. PID controllers use a three basic behaviour types or modes: P - Proportional, I - integrative and D – derivative. The transfer function of PID controller is as follows:

$$c(t) = K_p e(t) + K_i \int e(t)dt + K_d \frac{d}{dt} e(t) \quad (1)$$

Where,

K_p is gain coefficient of proportional controller;

K_i is gain coefficient of integral controller;

K_d is gain coefficient of differential controller;

e(t) is the error signal i.e. difference between present and reference value.

The equivalent transfer function in Laplace domain of PID controller:

$$C(s) = K_p E(s) + K_i E(s)/s + K_d E(s)s \quad (2)$$

The simplified block diagram of a PID block employed in the automatic voltage regulator control loop is shown in Fig. 3[18]. The PID block along with, the system loop gain K_G gives a flexible term quite for fluctuations in system input voltage in the power converting bridge [18], [19]. The proportional gain or action

in PID produces a control action proportional to the error signal and thus affects the rate of rise after a modulation has been introduced into the control loop.

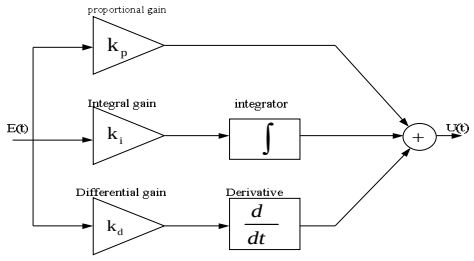


Fig. 2 Transfer function model of PID Controller

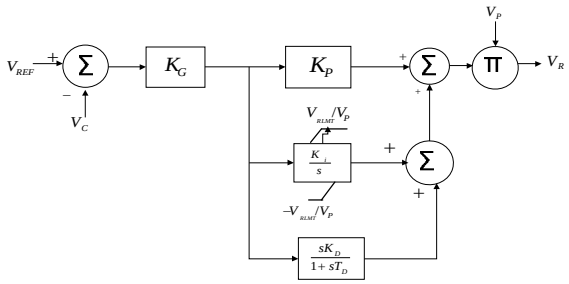


Fig. 3 Simplified block diagrams of automatic voltage regulators

The integral action output depends on the integral of the error. The integral response of a continuous control system, changes continuously in the direction so as to minimize the error, until the error is restored to zero. The derivative action output depends on the rate of change of error.

Teaching Learning Based Optimization Technique (TLBO)

Fundamentals of Teaching Learning based Optimization Algorithm

In this paper TLBO algorithm is used to tune the controller parameters to control the active power balance between load and demand. Teacher and learners are the two important components of the algorithm. There are two vital means of learning which are a teacher and learners. In teaching phase, the teacher tries to increase the mean result of his students (learners) by his capability. The output in

TLBO algorithm is treated in terms of grades or results of the learners and the output which is the best solution depends on the quality or capability of teacher. Therefore the teacher is treated as a highly educated person who teaches the learners in order that they can obtain better results or score in form of the marks obtained by them. Furthermore, learners acquire knowledge by interacting with each other which helps them in betterment of their results [20].A mathematical model is formed and applied for the optimization of an unconstrained non-linear continuous function, to develop a novel optimization technique called Teaching–Learning-Based Optimization (TLBO). TLBO [2], [21] is also a population based method which uses a population of solutions to arrive at a global solution. In this optimization algorithm a group of learners is considered as population and different design variables are considered as different subjects which are offered to the learners and learners' result is equivalent to the 'fitness' value of the optimization problem. In the whole population the best solution is considered as the teacher. The functioning of TLBO is divided into two parts, 'Teacher phase' and 'Learner phase'.

Particle Swarm Optimization Algorithm (PSO)

The Particle swarm optimization is type of evolutionary algorithm introduced by Kennedy and Eberhart in 1995. PSO is population-based stochastic search/optimization technique which is capable to handle the non-differential objective function and does not get trapped in local minima point [23], [24]. The PSO algorithm is a set of particles (considered as the optimization variables) called $X_{i,}$ where i means i^{th} particle. These are a set of variable value that create a swarm and which diffuse in the search space with a distinct particle velocity V_i. Each particle consists of individual best value p_{best} and the swarm consist a global best value $g_{best.}$ According to these individual best p_{best} and global best g_{best} the value of particles and its velocity is updated using equation shown below:

$$V_i^{(j+1)} = W * V_i^{(j)} + C_1 * rand_1 * \left(pbest_i^{(j)} - X_i^{(j)}\right) + C_2 * rand_2 * (gbest^{(j)} - X_i^{(j)}) \quad (7)$$

$$X_i^{(j+1)} = X_i^{(j)} + V_i^{(j+1)} \quad (8)$$

where, $V_i^{(j+1)}$ is the velocity of the i^{th} particle at j^{th} iteration; W is the weighting function; C_1 and C_2 are positive weighting factor; $rand_1$ and $rand_2$ are random number between zero to one; $pbest_i^j$ is the individual best of the i^{th} particle in j^{th} iteration; $gbest_i^j$ is the global best in j^{th} iteration; $X_i^{(j)}$ is the variable value as i^{th} particle in j^{th} iteration. The coefficients are $C_1 = C_2$=2.05 and W=0.7 taken inproposed algorithm.

Results and Discussion

The TLBO & PSO algorithm is used in the proposed work to tune the conventional PID controller. The transient behavior of the isolated 1.3-MVA Small-Hydro power plant is analyzed through the voltage stability. The maximum number of population and iterations are taken 30 and 100 respectively for both optimization techniques. The objective function for the algorithm is ITAE of the sum of the error signal of both excitation and governor system. The Optimal values of the gain of conventional PID controller are shown in Table-1.

Table-1The optimal value of gain of proposed controller

Algorithm	**Gain**	**Optimal values of Gain**	
		Governor System	**Excitation System**
PSO	K_p	1.7082	0.2095
	K_i	1.3472	0.1978
	K_d	1.2628	0.6202
TLBO	K_p	0.7123	0.2895
	K_i	0.0286	0.1109
	K_d	1.1508	0.0145

The TLBO gives the better results than the PSO algorithm. The terminal voltage (pu) and output electrical power (pu) for the proposed work is shown in Figs. 4 and 5. It can be seen that the TLBO will give better result than PSO with PID controller. It provides less overshoot and gives the faster response to the system to settle down quickly with less settling time.

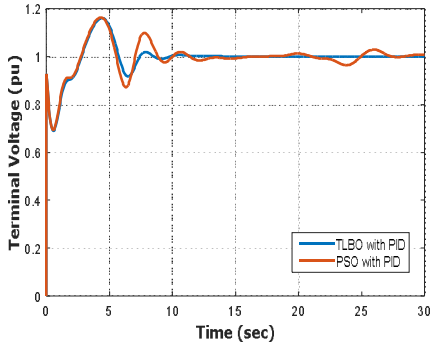


Fig. 4 Terminal Voltage Vs Time

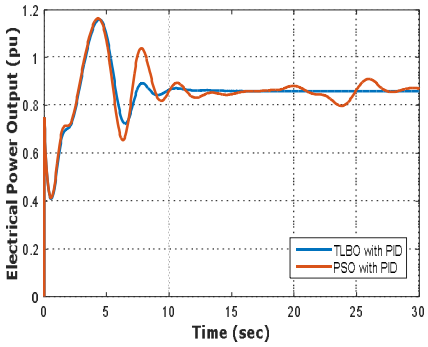


Fig. 5 Electrical Power Output Vs Time

Conclusions

The proposed work uses the two optimization technique named as TLBO and PSO to analyze the transient behavior of the system and improve the voltage stability of the system. It can be observed that the TLBO provides a better optimal solution of conventional PID controller than the PSO algorithm. TLBO offers better controller parameter and give less undershoot and overshoot in terminal voltage and electrical power output waveform and very less settling time as compared to PSO. So the results obtained that the controller parameters of conventional PID optimized by the TLBO algorithm yield better transient response.

References

[1] F. R. Pazheri, M. F. Othman, and N. H. Malik, "A review on global renewable electricity scenario," *Renew. Sustain. Energy Rev.*, vol. 31, pp. 835–845, 2014.

[2] R. V. Rao, V. J. Savsani, and D. P. Vakharia, "Teaching–learning-based optimization: a novel method for constrained mechanical design optimization problems," *Comput.-Aided Des.*, vol. 43, no. 3, pp. 303–315, 2011.

[3] G. Ardizzon, G. Cavazzini, and G. Pavesi, "A new generation of small hydro and pumped-hydro power plants: Advances and future challenges," *Renew. Sustain. Energy Rev.*, vol. 31, pp. 746–761, 2014.

[4] Wijesinghe and L. L. Lai, "Small hydro power plant analysis and development," in *Electric Utility Deregulation and Restructuring and Power Technologies (DRPT), 2011 4th International Conference on*, 2011, pp. 25–30.

[5] N. Kishor, R. P. Saini, and S. P. Singh, "A review on hydropower plant models and control," *Renew. Sustain. Energy Rev.*, vol. 11, no. 5, pp. 776–796, 2007.

[6] L. Spitalny, D. Unger, and J. M. A. Myrzik, "Potential of small hydro power plants for delivering control energy in Germany," in *Energytech, 2012 IEEE*, 2012, pp. 1–6.

[7] P. Kundur, N. J. Balu, and M. G. Lauby, *Power system stability and control*, vol. 7. McGraw-hill New York, 1994.

[8] K. R. Padiyar, *Power system dynamics*. BS publications, 2008.

[9] C.-C. Lee, J.-C. Hsu, and C. Jaing, "Optical coatings on polymethyl methacrylate and polycarbonate," *Thin Solid Films*, vol. 295, no. 1–2, pp. 122–124, 1997.

[10] K. Kim and R. C. Schaefer, "Tuning a PID controller for a digital excitation control system," *IEEE Trans. Ind. Appl.*, vol. 41, no. 2, pp. 485–492, 2005.

[11] M. G. Molina and M. Pacas, "Improved power conditioning system of micro-hydro power plant for distributed generation applications," in *Industrial Technology (ICIT), 2010 IEEE International Conference on*, 2010, pp. 1733–1738.

[12] G. Baidya, "Development of small hydro," *Himal. Small Hydropower Summit*, vol. 12, p. 13, 2006.

[13] F. P. Demello*et al.*, "Hydraulic-turbine and turbine control-models for system dynamic studies," *IEEE Trans. Power Syst.*, vol. 7, no. 1, pp. 167–179, 1992.

[14] L. N. Hannett, J. W. Feltes, and B. Fardanesh, "Field tests to validate hydro turbine-governor model structure and parameters," *IEEE Trans. Power Syst.*, vol. 9, no. 4, pp. 1744–1751, 1994.

[15] M. Zhang, C. Liu, Y. Han, and G. Li, "Research on frequency oscillation of HVDC sending system in islanded mode of hydro power units," in *Power System Technology (POWERCON), 2014 International Conference on*, 2014, pp. 2394–2400.

[16] H. Goyal, T. S. Bhatti, and D. P. Kothari, "A novel technique proposed for automatic control of small hydro power plants," *Int. J. Glob. Energy Issues*, vol. 24, no. 1–2, pp. 29–46, 2005.

[17] H. Mohamad, A. A. Bakar, H. W. Ping, and H. Mokhlis, "An adaptive controller of hydro generators for smart grid application in Malaysia," in *Power System Technology (POWERCON), 2010 International Conference on*, 2010, pp. 1–6.

[18] M. Althubaiti, M. Bernard, and P. Musilek, "Fuzzy logic controller for hybrid renewable energy system with multiple types of storage," in *Electrical and Computer Engineering (CCECE), 2017 IEEE 30th Canadian Conference on*, 2017, pp. 1–6.

[19] K.-E. Arzén, "A simple event-based PID controller," in *Proc. 14th IFAC World Congress*, 1999, vol. 18, pp. 423–428.

[20] H. Patel and V. Agarwal, "Maximum power point tracking scheme for PV systems operating under partially shaded conditions," *IEEE Trans. Ind. Electron.*, vol. 55, no. 4, pp. 1689–1698, 2008.

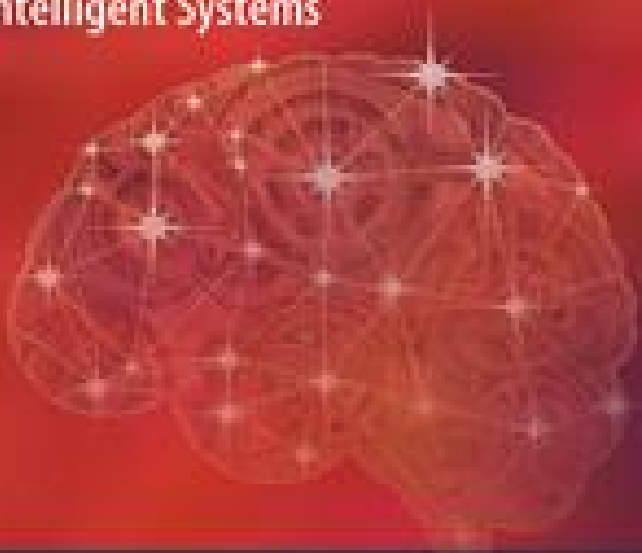
[21] R. V. Rao and V. Patel, "An improved teaching-learning-based optimization algorithm for solving unconstrained optimization problems," *Sci. Iran.*, vol. 20, no. 3, pp. 710–720, 2013.

[22] R. Rao and V. Patel, "An elitist teaching-learning-based optimization algorithm for solving complex constrained optimization problems," *Int. J. Ind. Eng. Comput.*, vol. 3, no. 4, pp. 535–560, 2012.

[23] A. H. Kardile, S. M. Mule, R. M. Nagarale, and U. D. Shiurkar, "Small Hydro Power Plant control based on Fuzzy Sliding Mode Controller using Particle Swarm Optimization algorithm," in *Electrical, Electronics, and Optimization Techniques (ICEEOT), International Conference on*, 2016, pp. 1274–1280.

[24] G. R. Chandra and G. Atchyut, "Genetic Algorithm Approach For The Position Control Of Permanent Magnetic Synchronous Machine."

Learning and Analytics in Intelligent Systems



Learning and Analytics in Intelligent Systems

Springer

Editors
Suresh Chandra Satapathy
Kalinga Institute of Industrial
Technology (KIIT)
Bhubaneswar, Odisha, India

Kumar Molugaram
University College of Engineering
Osmania University
Hyderabad, India

George A. Tsihrintzis
Department of Informatics
University of Piraeus
Piraeus, Greece

K. Srujan Raju
Department of CSE
CMR Technical Campus
Hyderabad, Telangana, India

Arkanti Krishnaiah
Department of Mechanical Engineering
Osmania University,
University College of Engineering
Hyderabad, India

ISSN 2662-3447 ISSN 2662-3455 (electronic)
Learning and Analytics in Intelligent Systems
ISBN 978-3-030-24313-5 ISBN 978-3-030-24314-2 (eBook)
https://doi.org/10.1007/978-3-030-24314-2

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Extraction of Electricity from Blast Induced Ground Vibration Waves – Case Study

Raghu Chandra Garimella[1(✉)] and Rama Sastry Vedala[2]

[1] Department of EEE, Methodist College of Engineering and Technology, Hyderabad, India
raghuchandhra@gmail.com
[2] Department of Mining Engineering, NIT Karnataka, Surathkal, India

Abstract. Generation of Electrical Energy has become a basic aspect in Power System because of increase in demand from the electrical community. Power can be generated in a different number of ways. Numerous developments were made in power generation technology for the generation of electricity, but those are all dependent on conventional sources. Generation of Electrical Energy using Piezo Sensors will efficiently convert unwanted vibrations into direct electricity. It is also evident that obtained electrical energy will be in the par with the input vibration intensity from the research studies.

Keywords: Seismic energy · Electricity generation · Piezo electricity · Seismograph

1 Introduction

The detonation of explosive charge in a typical blasthole under confinement releases a pressure in the form of chemical energy. The obtained chemical energy will further be converted into heat along with some force at the surroundings with a massive pressure [1]. Detonation of a explosive charge in a rock mass creates three major regions: (1) Explosion cavity, where explosion energy is liberated and the process is hydrodynamic; (2) Transition zone, where plastic flow, crushing and cracking occur; and (3) Seismic zone, where strain waves travel as seismic waves [2–4].

The process of detonation in a typical mine/quarry blast is dependent on the end effects involved. Initially, a part of the ruptured rock is closely associated to the strain wave, makes the ground vibrations to flow near the blasted hole. Later, the rock movement will begin due to fracture of rock mass. The energy transfer in to a rock mass will takes place in steps. Primary, development of fractures, also called as elastic and plastic deformation of the rock mass, will happen. Further, heat transfer in the rock mass will occur. Finally, movement of rock mass will be observed due to gases venting through open fractures and stemming [5].

In the earlier research, various monitoring instrumentation tools were used (viz. Vibration monitors, high-speed camera of 1000 fps capacity, and fragmentation monitoring systems), to analyze the dynamics of the blast and thereby the vibration parameters.

S. C. Satapathy et al. (Eds.): ICETE 2019, LAIS 2, pp. 285–292, 2020.
https://doi.org/10.1007/978-3-030-24314-2_36

2 Piezo-Gen Technique

Piezoelectricity is a generation of electricity in some solid substances due to application of mechanical stress/pressure. The word "piezo" originated from the Greek literature "piezein" indicates to squeeze or press, and "electric" or "electron", originated from "amber", which is an ancient source of electricity. French physicists, Curie and Curie, had discovered the concept of piezoelectricity in the year 1880 [6–8].

Piezoelectricity is also the competence of solid materials, viz. crystalline, ceramic substances, to produce an electric potential (EMF) due to the mechanical stress or heat on them [7, 9]. Nevertheless, piezoelectricity is not due to change in the surface charge density, however, by dipole density of the material. From the earlier literature, application of 2kN force over a 1 cm^3 volume of quartz material can generate an electrical voltage of about 12500 V [10]. Physical expansion and contraction of a piezoelectric material changes the dipole moment (p = q.d), creating a voltage (Fig. 1).
where,

p = q.d = dipole moment, C-m
q = magnitude of electrical charge, C
d = distance between two poles, m.

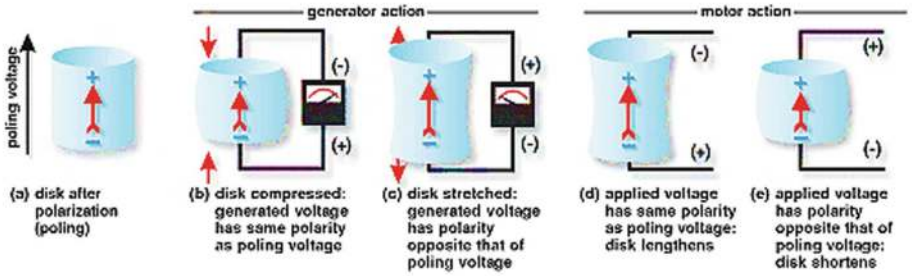


Fig. 1. Working mechanism of simple piezo transducer [11]

3 Assessment of Seismic Energy

3.1 Ground Vibrations Monitoring

During the research studies, the intensity of blast induced ground vibrations was monitored using three units of Minimate Plus, Instantel, Canada. These ground vibration monitors are of 8-Channels. In the four channel instruments, the first three channels record three mutually orthogonal ground vibration components, namely Transverse, Vertical and Longitudinal. The fourth channel records the noise level-using microphone. Minimates with geophones and microphones connected were placed at different distances covering both short and long distances, from the blast site. The vibration events were later transferred to a computer using advanced blastware software. Generally, the dynamics of blast induced ground vibrations were monitored at

specified distances from blast site with a geophone/ground vibration monitor in three mutually orthogonal – longitudinal, transverse and vertical directions. Among all these waveforms, whichever is the peak, that particular absolute value was taken as peak particle velocity (PPV). Seismic energy was estimated for all the signals in three directions using DADiSP signal processing software. DADiSP is a signal processing tool/software, using which shock energy dissipated in the form of waves is calculated. Longitudinal, Transverse and Vertical component of blast vibration event were imported from blastware software to digital signal processing software DADiSP in ASCII format. Fast Fourier Transformation (FFT) was performed subsequently to find the frequency component of the time domain of blast wave signal as blast wave recorded by Minimate Plus and processed by Blastware falls in the category of random progressive signal. The estimation of absolute area describes the intrinsic energy of the blast wave signal distributed in various frequency bands. The energy of the signal x(t) is given by $\int_{-\infty}^{\infty} |\boldsymbol{x}(\boldsymbol{t})|^2 \, dt$ [12].

4 Field Investigations and Results

Blasts were carried out in various mines for the extraction and assessment of seismic energy. Ground Vibration monitors were placed near blast field at various distances to find the impact of blast on nearby structures. Geophones were attached to the ground with the help of Plaster of Paris for proper contact. The developed piezo generator circuits were placed in the similar locations where conventional seismographs are positioned [13]. Altogether, 55 blasts were studied and electrical energy was tapped. In total, 10 blasts were carried out in Choutapalli limestone mine, 11 blasts were carried out in Yepalamadhavaram limestone mine and 34 blasts were carried out in Singareni Collieries Company Ltd.

The following are some photographs depicting obtained electricity from undesirable seismic waves, extracted through the developed piezo-gen circuit in various mine locations (Figs. 2, 3 and 4) [13]. The various seismic data collected at various distances in different blasts are compared with the obtained electrical energy data as shown in the below Tables 1 and 2.

Fig. 2. Extraction of electricity using Piezo-Gen circuit from undesirable blast vibrations at limestone mine

Fig. 3. Observation of obtained voltage from the blast vibrations by multimeter for the assessment of seismic energy

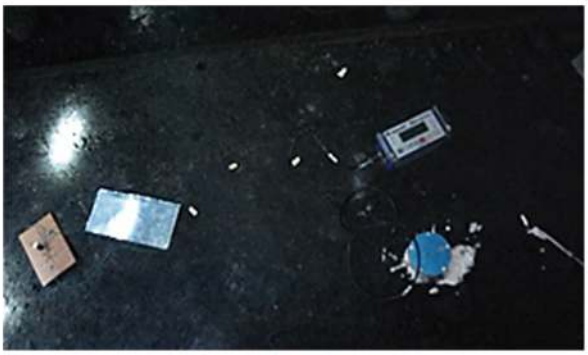


Fig. 4. Piezo-Gen circuit placed beside the geophone underground coal mine

Table 1. Summary of extracted electricity from blasts conducted in limestone mines

Sl. no.	Distance (m)	MCD (kg)	PPV (mm/s)	Seismic energy (MJ)	Electricity extracted (MJ)
1	100.00	30.17	30.60	248254	245232
2	125.00	30.17	22.40	1299398	1202928
3	130.00	30.17	9.40	80993	76343
4	108.00	36.67	6.10	347919	300540
5	120.00	36.67	4.95	49502	42653

Table 2. Summary of extracted electricity from blasts conducted in underground coal mine

Sl. No.	Distance (m)	MCD (kg)	PPV (mm/s)	Seismic energy (MJ)	Electricity extracted (MJ)
1	54.75	2.59	2.67	156122	123185
2	58.28	2.59	1.02	59990	44402
3	67.80	2.59	4.19	7133334	5250688
4	61.85	3.33	7.49	486001	439429
5	63.64	3.33	5.08	61229	33356
6	68.74	3.33	5.08	4500852	3037611
7	61.81	2.96	3.55	405538	320185
8	66.67	2.96	1.52	98359408	81513971
9	73.62	2.96	2.15	3215421	2113462
10	98.28	2.96	1.52	4766935	3618080
11	110.26	2.96	0.64	92201932	71141568
12	88.71	2.59	0.63	84232644	71975752
13	101.08	2.96	0.63	75042381	71675872
14	40.00	3.33	7.37	543915	303769
15	60.00	3.33	6.10	40070581	31248263
16	62.09	3.33	5.08	920512	757222
17	35.00	2.96	5.59	33162509	22980792
18	55.00	2.96	5.72	28491223	21762289
19	61.85	2.96	4.83	1388977	1122289
20	70.00	2.96	4.45	8638939	7328110
21	35.11	3.33	22.22	37634381	17394886
22	45.08	3.33	17.40	7741455	7402328
23	55.07	3.33	7.24	55507124	22103881
24	40.00	2.59	8.38	17768342	11519133
25	50.00	2.59	1.78	33645	18533
26	60.00	2.59	4.70	5883851	4534639
27	60.00	2.96	5.59	30312788	21312155
28	80.00	2.96	6.73	150689	125553
29	100.00	2.96	2.54	5659210	3921140

Typical sample event report and FFT reports generated (Figs. 5 and 6). Seismic energy has obtained from the events recorded using signal-processing tool, DADiSP. Sample of signal processing window is shown in Figs. 7 and 8.

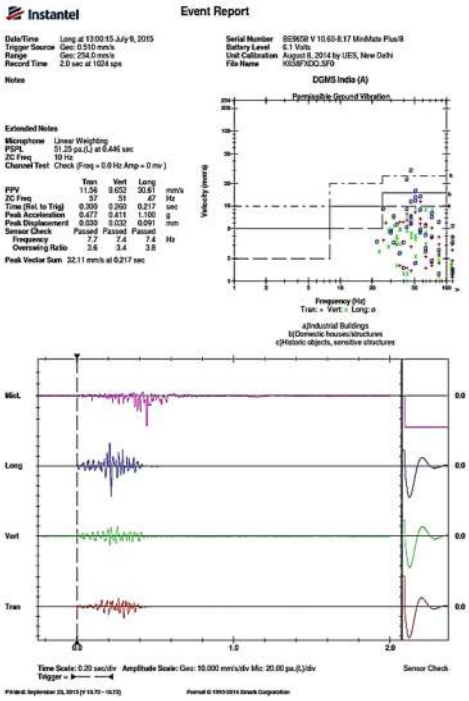


Fig. 5. Typical event report

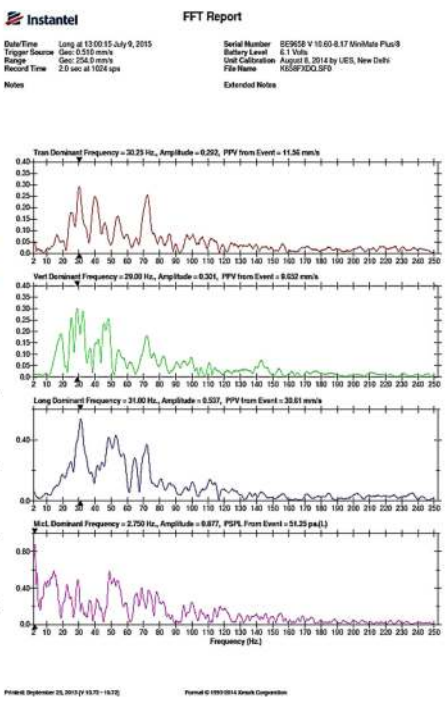


Fig. 6. Typical FFT Report from Blastware

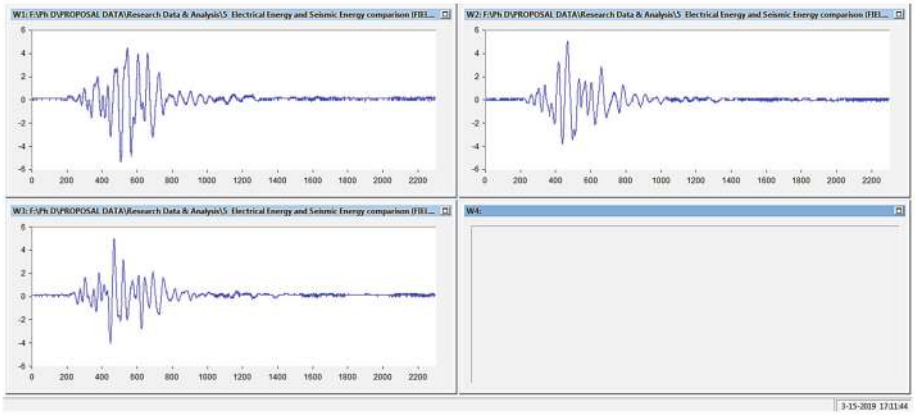


Fig. 7. Sample of signal processing window

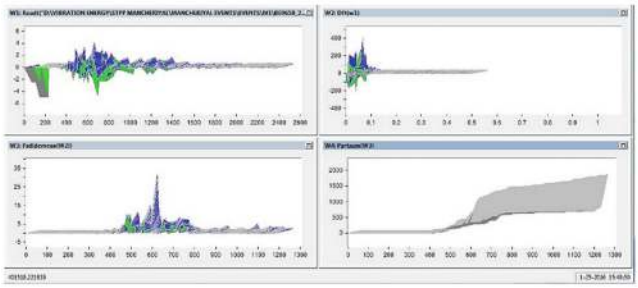


Fig. 8. Estimation of seismic energy

Also, comparison of seismic energy with the generated electrical energy has made to observe the amount of undesirable vibrations which were converted to electricity (Figs. 9 and 10). From the analysis made (Figs. 9 and 10), it is observed that amount of seismic energy extracted in the form of Electricity is 80–90% of the total seismic energy in limestone mines and that is about 75–80% in the case of underground mine locations.

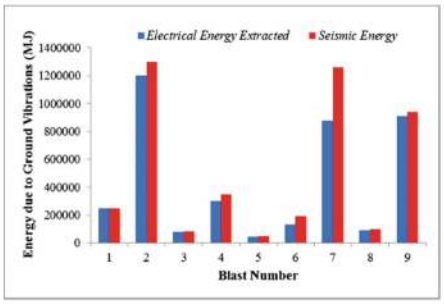


Fig. 9. Electricity extracted in limestone mine

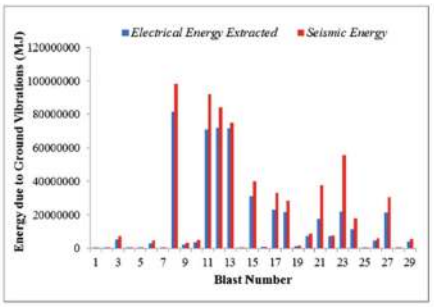


Fig. 10. Electricity extracted in coal mine

5 Conclusions

In the research study, detailed field investigations were carried out to estimate the seismic energy dissipated by ground vibrations caused due to blasting operations, using signal processing approach and to tap electricity from blast induced ground vibrations by piezo generator. Following are the main conclusions drawn from the research study:

- It was observed from previous literature, the amount of explosive energy distributed would be more in seismic form. From the results, it is observed that the amount of seismic energy is being increased with the increase in Maximum charge per delay; hence, the optimal usage for MCD will improve the performance of blast by reducing seismic losses further optimizing explosive utilization.

- From the research studies, it is clear that blast induced ground vibrations may be effectively tapped and converted into useful electrical energy with the developed patented Piezo-Gen circuit (Indian Patent Application No.: 201941002334A, published on Jan. 25, 2019).
- The use of DADiSP for the assessment of seismic energy is an excellent advantage to the industry for doing effective signal processing mechanisms in a simple manner.
- It is also observed that amount of seismic energy obtained in case of limestone mines is much higher than underground coalmines. Therefore, explosive energy losses in limestone mines are more than in case of underground coal mine.
- In addition, it is observed in the case of underground mine that even with the parting more than 70 m between the blast location and monitoring station, the vibrations will travel effectively giving tendency to get more energy loss. In such cases, the application of Piezo-Gen circuit will gives a chance to extract some amount of undesirable blast wave energy.
- Hence, the Piezo-Gen circuit has become as a renewable source for generation of electricity from blast vibrations and further will be more useful in assessing the seismic energy in blast field.

References

1. Johansson CH, Persson PA (1970) Detonics of high explosives. Academic Press, Cambridge
2. Atchison TC, Duvall WI, Pugliese JM (1963) Effect of decoupling on explosion-generated strain pulses in rock. Bureau of Mines, College Park, MD (USA)
3. Nicholls HR (1962) Coupling explosive energy to rock. Geophysics 27:305–316
4. Sastry VR (1989) A study into the effect of some parameters on rock fragmentation by blasting. Unpubl. Ph Thesis BHU India (1989)
5. Sanchidrian JA, Segarra P, Lopez LM (2007) Energy components in rock blasting. Int J Rock Mech Min Sci 44:130–147
6. Anon: All About Heaven - Some science behind the scenes. https://allaboutheaven.org/science/piezoelectricity/121
7. Curie J, Curie P (1880) Development by pressure of polar electricity in hemihedral crystals with inclined faces. Bull Soc Min Fr 3:90
8. Imai K, Tingley D, Yamamoto T (2013) Experimental designs for identifying causal mechanisms. J R Stat Soc Ser A Stat Soc 176:5–51
9. Pramathesh T, Ankur S (2013) Piezoelectric crystals: future source of electricity. Int J Sci Eng Technol 2:260–262
10. Curie J, Curie P (1881) Contractions and expansions produced by voltages in hemihedral crystals with inclined faces. C R 93:1137–1140
11. APC International Ltd. (2002) Piezoelectric ceramics: principles and applications. APC International
12. Sastry VR, Ramchandar K (2014) Assessment of performance of explosives/blast results based on explosive energy utilization. RD Proj. Rep.
13. Garimella RC (2019) Tapping of electricity from ground vibrations caused due to blasting operations in mines and quarries

2019 ICETE Nitte, Karnataka

2019 CTCS Nitte, Karnataka

International Conference on

Civil Engineering Trends and Challenges for Sustainability (CTCS 2019)

(Under the Aegis of ICETE 2019 - A Multi Conference Platform)

May 23-24, 2019 | N.M.A.M.I.T., Nitte

ice Institution of Civil Engineers Publishing

Springer

Publishing Partners

NITTE EDUCATION TRUST | N.M.A.M. INSTITUTE OF TECHNOLOGY
(An Autonomous Institution affiliated to VTU, Belagavi)
(ISO 9001:2015 Certified), Accredited with 'A' Grade by NAAC

About the Institute

Nitte Mahalinga Adyanthaya Memorial Institute of Technology (N.M.A.M.I.T.), Affiliated to VTU, Belagavi, is an Autonomous Institution offering UG, PG and Doctoral Programmes. The institute is a unit of Nitte Education Trust, Mangalore. The institute currently offers 7 - UG programmes, 11-M.Tech programmes in Engineering, MBA and MCA programmes. All UG Programmes are accredited by **National Board of Accreditation** (NBA), New Delhi and is a ISO 9001:2015 certified Institution. It has been recognized as a 'Lead Institution' under the World Bank Funded TEQIP programme (both Phase I & II) and also accredited with National Assessment and Accreditation Council (NAAC), New Delhi with 'A' Grade. The Institute is in the band width of 100-150 in National Institutional Ranking Framework (NIRF) ranking - 2018, Government of India.

About the Department

The Civil Engineering Department was started in 1987 with a UG Programme with an intake of 60. Annual Intake has been increased to 120 from the academic year 2012-13. M.Tech programme in Construction Technology was started in 2010 with an intake of 18 and M.Tech in Structural Engineering in the year 2017 with an intake of 24. The department is also recognized as a Research Centre under VTU, Belagavi offering M.Sc. (Engg.) and Ph.D. programmes. Presently 10 research scholars are pursuing their Ph.D. in the Department. In addition to this, the Department Students Association like OCEAN, IE(I), ISTE organizes seminars, workshops, educational tours, design competitions etc for civil engineering students. The department has taken up Karnataka State Council for Science & Technology (KSCST) and Nitte Deemed to be University funded research projects. The Department undertakes the consultancy and third party inspection from Government and private agencies. The department is recognized as ISRO-IIRS Outreach Center.

Civil Engineering Department is also working on development of Masonry Blocks and Paver Blocks using Industrial Waste Materials under Karnataka New Age Incubation Centre, N.M.A.M.I.T. funded by Dept. of IT, BT, S & T, Govt. of Karnataka. The department has been accredited by NBA for 3 years.

About the Conference

N.M.A.M. Institute of Technology is organizing International Conference on Emerging Trends in Engineering (ICETE 2019) on May 23 & 24, 2019, which is the 9th International Conference since 2011. For the year 2019, in order to focus on the specific issues associated with various Engineering disciplines, the idea of a Multi Conference Platform had been mooted.

INTERNATIONAL CONFERENCE ON EMERGING TRENDS IN ENGINEERING (ICETE 2019) - A MULTI CONFERENCE PLATFORM, will be a collection of several International Conferences with the themes specific to various engineering streams. Besides, there will be an opportunity for students and research scholars of various branches of Engineering & Technology, and industrial professionals to deliberate, present and discuss research papers.

Keynote Speaker

Dr. Mukesh Kashyap
Senior Lecturer (Construction Management)
School of Architecture Design and the Built Environment
Nottingham Trent University, Nottingham, Nottinghamshire, UK

Invited Speakers

Dr. G L Sivakumar Babu
Professor, Department of Civil Engineering,
Indian Institute of Science, Bengaluru.

Dr. Puttaraju
Principal,
SJB Institute of Technology, Bengaluru.

Er. Nagesh Puttaswamy
AGM, Regional Head Technical Services,
UltraTech Cement Ltd., Bengaluru.

Theme of the Conference

This year, CTCS 2019 is a part of the Multi Conference which will be a collection of several themes specific to different engineering streams organized under a single umbrella of ICETE 2019 - A Multi Conference Platform.

The theme of the conference is sustainable construction of Structures with new trends and challenges. The four main areas of paper submission are;

Construction and Structural Engineering
Risk Analysis, Safety and Security, Building Materials, Seismic Analysis of Structures, Concrete, Steel & Timber Structures, Composite Structures, Structural Health and Monitoring, Coastal Engineering,Masonry Structures, Offshore structures, Impact on climate change, Affordable Construction and Viability of Public-Private Partnership in Infrastructure Development.

Geotechnical Engineering & Transportation Engineering
Transportation system & Planning, Reinforced Earth Structures, Ground Improvement Techniques, Soil Dynamics, Stability of Earth Retaining Structures, Shallow & Deep Foundations, Rock Engineering & Tunneling, Analytical and Numerical modeling in Geomechanics, Analysis, Soil Conservation, Mitigation and Management of Geo hazards.

Environmental Engineering and Water Resource Engineering
Hydraulics and Water Resources Engineering, Waste Management, Reuse & Recycle technology, Heating, Ventilation and Air Conditioning, Water Conservation -Artificial recharge of ground water, Rain water Harvesting, Estimation of water resources, Interlinking of rivers and Interbasin water management.

Surveying and Geographical Information Systems
Applications of RS & GIS in Civil Engineering such as Satellite Image Analysis and Aerial photogrammetry, Infrastructure Management, Weather Monitoring and Effects of Climate Change.

Program Committee

Patron :
Sri. N. Vinaya Hegde, Chancellor, Nitte Deemed to be University,
President, Nitte Education Trust

General Chair :
Dr. Niranjan N. Chiplunkar Principal, N.M.A.M. Institute of Technology, Nitte

Co-Chair :
Dr. Shrinivasa Rao B.R., Vice Principal & COE
Dr. I. R. Mithanthaya, Vice Principal & Dean Academics

Conveners :
Dr. Sudesh Bekal, Dean – R&D
Dr. Muralidhara, PG Coordinator

Program Committee
Program Chair :
Dr. Udayakumar G. HOD, Civil Engg.

Co-ordinators :
Dr. Arunkumar Bhat, Professor, Civil Engg.
Mr. Janakaraj M., Asst. Professor, Civil Engg.

Publication Committee :
Dr. Mithun B. M.
Dr. Anil Kumar
Mr. Shriram P Marathe
Mr. Shanmukha Shetty
Mr. Thushar S Shetty

Hospitality Committee :
Mr. Y. R. Suresh
Mr. Y Umashankar Shetty
Mr. Roshan Rai

Accommodation/Transportation Committee :
Dr. Srinath Shetty K
Mr. Pushparaj A Naik
Mr. Pradeep Karanth

Venue Committee :
Dr. Anil Kumar
Mr. Shriram P Marathe
Mr. Rakshith Kumar Shetty
Mr. Prithviraj H. K.

Registration Committee :
Dr. S. K. Mahadeve Gowda
Mr. Sabyath Shetty
Ms. Thanushree Hegde

Web/Advertise Committee :
Dr. Radhakrishnan K.
Ms. Thangamani R
Mr. Manjunath M.

Refreshment Committee :
Mr. Gururaj Acharya
Mr. Prashanth Kumar

Miscellaneous :
Mr. J. K. Lokesh
Mr. Sundip Shenoy
Mr. Sushanth S. B.
Dr. Bhojaraja, B.E
Mr. Shaik Kabeer Ahmed
Mr. Ranjith A

Secretary :
Dr. Gururaj Upadhyaya
Assistant Professor, Dept. of Mechanical Engg, N.M.A.M.I.T, Nitte

Steering Committee :
- **Sri. Vishal Hegde,** Pro-chancellor, Nitte-Deemed to be University
- Dr. N.R Shetty, Chancellor, Central University of Karnataka, Gulbarga, Karnataka
- Dr. B.S. Sonde, Director, ASM Technologies Ltd, Bangalore
- Dr. G. Hemantha Kumar, Vice Chancellor, Mysore University, Mysore
- Dr. Omid Ansary, Senior Associate Dean and Professor, Penn State University, U.S.A
- Dr. Samson Ojoawo, Deputy Dean, Faculty of Engg. & Technology 'LAUTECH', Nigeria
- Dr. Shripad T. Revankar, Professor, Purdue University, U.S.A
- Dr. Shuhaimi Mansor, Professor, Universiti Teknologi, Malaysia

Organizing Committee :

- Sri. Yogeesh Hegde, Registrar (NET Campus)
- Dr. Subrahmanya Bhat, Professor & Dean (Student Welfare)
- Dr. K Rajesh Shetty, Dean (Admission & Alumni Affairs)
- Dr. Srinath Shetty K, Resident Engineer
- Dr. Srinivas Pai P, Deputy Controller of Examinations
- Dr. Uday Kumar K Shenoy, Professor, Department of Computer Science Engineering
- Dr. P Shankaran, Professor & Head, Department of Mathematics
- Dr. Manjunath K B, Assistant Professor & Head, Department of Physics
- Dr. Ramesh Bhat, Associate Professor & Head, Department of Chemistry
- Dr. H. Divakar Bhat, Librarian
- Dr. Rashmi D Hegde, Professor & Head, Department of Humanities
- Mr. Krishnaraja Joisa, Public Relation Officer

Conference Advisory Committee :

- Dr. Mukesh Kashyap, Senior Lecturer (Construction Management) School of Architecture, Design and the Built Environment, Nottingham Trent University, England
- Dr. G L Sivakumar Babu, Professor, IISc Bengaluru
- Dr. Dharamveer Singh, Associate Professor, IIT Bombay
- Dr. H N Ramesh, Professor & Principal, UVCE, Bengaluru
- Dr. Puttaraju, Professor & Principal, SJBIT, Bengaluru
- Dr. Varghese George, Professor & Head, Civil Engineering, NITK, Surathkal
- Dr. Vipul Prakash, Professor, IIT Roorkee
- Dr. G P Chandradhara, Professor & Head, CT & M, JSS S&T University, Mysuru
- Dr. N. Suresh, Professor & Head, Civil Engg & Director of BFRC, NIE, Mysuru

Technical Advisory Committee :

- Dr. M C Narasimhan, Professor, NITK, Surathkal
- Dr. R Shivashankar, Professor, NITK, Surathkal
- Dr. Katta Venkataramana, Professor, NITK, Surathkal
- Dr. A U Ravishankar, Professor, NITK, Surathkal
- Dr. S Shrihari, Professor, NITK, Surathkal
- Dr. B B Das, Associate Professor, NITK, Surathkal
- Dr. Prashanth J, Assistant Professor, NIT Silchar
- Dr. Umesh B, Assistant Professor, NIT Warangal
- Dr. Kiran Kumar Shetty M, Professor, MIT, Manipal
- Sri. V Madhava Rao, Associate Professor, JSS S&T University, Mysuru
- Dr. N C Balaji, Assistant Professor, NIE Mysuru
- Dr. Nitendar Palankar, Associate Professor, KLS GIT, Belagavi
- Dr. Sanjeev Sangami, Associate Professor, JCE, Belagavi

Important Dates

Submission of Full length manuscript	:	16 Mar 2019
Notification of acceptance	:	31 Mar 2019
Submission of Camera-ready manuscript	:	10 Apr 2019
Last date for registration	:	01 May 2019

Conference Location – Nitte

The Institute is located on the Padubidri-Karkala State Highway (SH01) which is 10 km away from Karkala, well connected with Mangalore (60 KM) and Udupi/Manipal (45 KM) through NH66 & NH169. The participants can alight at Mangalore or Udupi Railway Stations/Bus Terminals or Mangalore Airport to reach the Institute.

Message by Principal

I am very happy to note that the Department of Civil Engineering at NMAM Institute of Technology, Nitte is organizing an International Conference on "Civil Engineering Trends and Challenges for Sustainability (CTCS 2019)" under the broad umbrella of Multi Conference titled "International Conference on Emerging Trends in Engineering (ICETE2019)". I am sure that the organizers of the Conference have tried their level best in making CTCS2019 a grand success.

Any Conference of this sort gives a platform for the researchers and faculty members to network with each other and exchange ideas. I understand that CTCS2019 has more than 110 papers accepted for oral presentation. These presented papers will once again be reviewed by the Guest Editors of the ICE and Springer journal of relevant theme and finally selected papers will appear in the said Journals. I wish all the paper presenters all the very best.

Wishing the Conference every success.

Prof. Niranjan N.Chiplunkar

Principal, NMAMIT-Nitte

Message from Vice Principal and Dean (Acd.)

NMAMIT started its first International Conference on Emerging Trends in Engineering (ICETE) from 2011 with an intention to provide platform for Post Graduation and Research Scholars of Engineering & Technology and Industry Professionals to deliberate, explore and contribute their research findings. Since eight years, this conference attracted many researchers with scholarly contributions.

Under this platform,I am very happy to know that Department of Civil Engineering, NMAMIT, Nitte is organizing International Conference on "Civil Engineering Trends and Challenges for Sustainability" (CTCS-2019) which is scheduled on 23rd & 24th May,2019.The main theme of the conference is sustainable construction of Structures with new trends & challenges .There will be an opportunity for PG students and research scholars to deliberate, present and discuss various issues of Civil Engineering Construction. I came to know that department received a very good response from India & abroad and 120+ papers were selected for presentation after critical review. I am also happy to hear that during the Conference Eminent Key note speakers from reputed organizations & Industries as well as from foreign universities will share their experiences. I appreciate the effort taken by Program Coordinator Dr. Arun Kumar Bhat of CTCS-2019 and his team in making this Conference a truly International Conference with high quality standard technical papers.

In summary, the members of the program committee have put all efforts to make this conference, truly an International one with quality papers on board. I congratulate all members of program committee for their effort and hard work. I wish the program every success.

Dr. I. R. Mithanthaya
Vice Principal & Dean (Academics)
N.M.A.M.I.T. Nitte

NITTE EDUCATION TRUST

N.M.A.M. INSTITUTE OF TECHNOLOGY
(An Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi)
Nitte – 574 110, Karnataka, India
ISO 9001:2015 Certified
Accredited with 'A' Grade by NAAC

Dr. Shrinivasa Rao B R
Vice Principal & Controller of Examinations

☎: 08258 - 281039 – 281263
Fax: 08258 – 281265 Extn: 202

Date: 21-5-2019

Message

I am pleased to know that the Department of Civil Engineering, N.M.A.M. Institute of Technology, Nitte is organizing a Two-Day International Conference on **"Civil Engineering Trends and Challenges for Sustainability (*CTCS 2019*)"** under the aegis of ICETE-2019: International Conference on Emerging Trends in Engineering on 23rd and 24th May, 2019.

I congratulate the organizers of CTCS-2019 for providing a platform to bring together researchers and practitioners from academia and industry to focus on recent systems and techniques in the broad field of Civil Engineering. I am sure the conference will be an incentive for the participants from various levels and will be useful and informative for all.

I convey my best wishes for the success of the conference.

Dr. Shrinivasa Rao B R

Message by Dean (R&D)

The ICETE conference series has changed its shape to become a multi conference with five conferences being run parallel.

CTCS 2019, the International conference of Civil Engineering department is planning to bring out the compendium of abstracts containing information about large number of papers received for presentation. It is a great effort on the part of conveners and I am appreciative of the fact.

It is worthwhile to note that with too much of specialization in every branch of engineering it is meaningless to have single conference catering to all. This ICETE 2019 multi-conference is the big step in the right direction; what with so many experts and speakers available at hand with participants and researchers.

I congratulate the editors and the editorial team for coming out with this compendium and wish conveners and office bearers of CTCS 2019 all the best.

Dr. Sudesh Bekal
Dean (R&D)/Convener ICETE 2019 Multi-Conference

Message from HOD

The department of civil engineering is organising International conference on Civil Engineering Trends and Challenges for sustainability (CTCS 2019) under the aegis of multi international conference ICETE-2019. This is the proud moment for the department to organise such a conference for the first time independently. I am happy to note that more than 120 papers are being presented in the conference and the selected papers will be published either in ICE or Springer nature. I congratulate Dr.Arun Kumar Bhat, the convener of CTCS 2019 and the entire team for their excellent work.

The department has a faculty strength of 32 with 7-professors,1-associate professor and 24-assitant professors. There are 10-Ph.D holders and 10 members are pursuing their Ph.D. The department has wide spectrum of specialisation covering almost all areas of specialisation.

I wish the conference every success.

Dr.Udayakumar G

Head of the Department and Program Chair-CTCS 2019

Message from Convener of CTCS 2019

The department of civil engineering is organizing International Conference on Civil Engineering Trends and Challenges for sustainability (CTCS 2019) with a focus on the specific issuesassociated with various Civil Engineering streams. This is a multi-Conference under the aegis of ICETE. The CTCS will be an opportunity for students and research scholars of various streams of Civil Engineering and consulting professionals to deliberate, present and discussresearch papers.

The theme of the conference is sustainable construction of Structures with new trendsand challenges. The four main areas of paper submission are;

- Construction and Structural Engineering.
- Geotechnical Engineering & Transportation Engineering.
- Environmental Engineering and Water Resource Engineering.
- Surveying and Geographical Information Systems.

The Conference has received 151 papers from across the country of which 122 papers were selected for presentation. The reviewed, presented and selected papers will be published in either of theProceedings of Institutionof Civil Engineers (ICE) or Proceedings of CTCS in Springer Nature

Dr. Arun Kumar Bhat
Professor in Civil Engineering
Convener - CTCS 2019

.

About ICETE-2019

The 9th International Conference on Emerging Trends in Engineering (ICETE-2019 A multi conference platform) will be held on 23rd & 24th May 2019 at NMAM Institute of Technology, Nitte, Karnataka. The idea of multi conference platform has been mooted in order to focus on the specific issues associated with various Engineering fields.

NMAM Institute of Technology, Nitte has been organizing International Conference on Emerging Trends in Engineering (ICETE) annually since 2011. ICETE aimed to provide a proper platform for Research scholars, Post Graduate students of Engineering & Technology and Industry professionals to deliberate, explore and contribute their research findings and to discuss the latest developments in the field of Engineering & Technology. Invited technical talks by eminent personalities from IIT and Foreign Universities on current topics of relevance, in different streams of engineering were also organized to help the participants in up-gradation of their knowledge about the recent advances in Engineering & Technology.

This year, **ICETE-2019 - A Multi Conference Platform** will be held as a collection of several International Conferences with themes specific to different engineering streams organized under a single umbrella. Following is the list of various International Conferences under **ICETE-2019 - A Multi Conference Platform.**

About NMAMIT

NMAM Institute of Technology, Nitte, was established in 1986. The college is affiliated to the Visvesvaraya Technological University, Belagavi and is recognised by the All India Council for Technical Education, New Delhi. Institute is accredited by National Assessment & Accreditation Council [NAAC] **with 'A' grade with a CGPA of 3.11 out of 4 till 20th October 2022.** Seven UG Programs ie. BE (Civil), BE (E&E) , BE (BT) , BE (Mech), BE (CS) , BE (IS) and BE (EC) are accredited by NBA, New Delhi under Tier - I category till 30th June 2021. Institute is certified to the ISO 9001-2015 standards for quality education by NVT Quality Certifications (ANAB accredited). The institution has been granted Academic Autonomy under the Visvesvaraya Technological University from 2007-08. The annual intake of students is 1080 for UG and 518 for PG, with over 5000 students studying in the campus.

NMAM Institute of Technology, Nitte, offers Undergaduate programme in seven disciplines of Engineering viz: Civil Engineering, Electrical and Electronics Engineering, Electronics and Communication Engineering, Computer Science and Engineering, Information Science and Engineering and Bio-Technology. The specialization in Postgraduate (M.Tech.,) programme include Construction Technology, Structural Engineering, Machine Design, Energy System Engineering, Power Electronics, Digital Electronics and Communication, VLSI Design & Embedded Systems, Computer Science & Engineering, Computer Network Engineering, Software Engineering and Industrial Biotechnology. All the departments have been recognized as research centers for offering M.Sc. (Engg) & Ph.D programmes under VTU. The Institute also offers Postgraduation and Research programmes inComputer Applications and Business management along with Ph.D. programmes in Basic Science and Mathematics.

The Principal of NMMAIT, Prof. (Dr.) Niranjan N Chiplunkar, holds a doctorate in Computer Science & Engineering from the University of Mysuru and has over 30 years of teaching experience. He was bestowed with the “Excellent Achievement” award by the Centre for International Cooperation on Computerization (CICC), Govt. of Japan (2002) and Bharateeya Vidya Bhavan’s “Best Engineering College Principal” award by ISTE New Delhi (2014)

NMAMIT has established a Research and Innovation Centre (RIC) with 8,000 sq. ft. of laboratory space to promote research and innovation. It houses the research facilities like, Centre for Tool Based Micromachining Research, Centre for Condition Monitoring Research, Centre for Advanced Machining Research, Centre for Research on Vibration Isolation System, Centre for System Design, Fabrication and Testing, Centre for I.C Engine Research, Centre for High Performance Computing, Biofuel Information and Demonstration Centre, Centre for Innovation in Biofuel Production. A **New Start Up Eco Space** with 7000sq.ft area is coming up and will be ready by end of December 2018, which will have co-working space and all the infrastructural facilities that will allow young incubators to start their ventures. The mentorship and the help to get the financial support will be extended through this facility.

The Department of Science and Technology (DST), Govt. of India established the Entrepreneurship Development Cell (EDC) at NMAMIT in 2004 to conduct training programs to promote development of business ventures/small scale industries/micro enterprises and promote employment opportunities in the region as well as to create entrepreneurial culture in institutions and colleges in and around Nitte. Students are encouraged to start their own ventures and all necessary help and guidance is given. A Vocational Training Centre has been established at NMAMIT in association with the Directorate of Industries and Commerce, Bengaluru with the objective of enhancing the employability of uneducated youth by providing required training. Karnataka Biotechnology & Information Technology Services (KBITS), an autonomous organization established under the Department of Information Technology & Biotechnology, Govt. of Karnataka, has selected NMAMIT as one of the first Nine engineering colleges for 'Karnataka New Age Incubation Network'.

The college has a MoU with Penn State University, Harrisburg, USA and Ritsumeikan University, Japan for faculty and student exchange programs, with respect to research and projects. Department of Biotechnology has an understanding with National University of Singapore Professors for training their students in the advanced areas.

CONFERENCE ABSTRACTS

(CTCS-2019)

Estimation of burden rock movement with the energy distribution – case study

Raghu Chandra Garimella
Department of EEE
Methodist College of Engineering and Technology
Hyderabad, India
raghuchandhra@india.com

Rajasekhar Ballari
Civil Engineering
National Institute of Technology Karnataka, Surathkal
Mangalore, India

Rama Sastry Vedala
Mining Engineering
National Institute of Technology Karnataka, Surathkal
Mangalore, India

Abstract—In an opencast mine, Blasting can be considered as the most important activity. Proper usage of explosive energy to displace burden can result in considerable savings to operations, which normally depend on mechanical means for material removal. Optimization of explosive energy in blast design is achieved with the effective utilization of explosive energy in a blasthole. The occurrence of a blast is so rapid that the naked eye cannot detect the process. A high-speed video camera can provide the progress of blast in millisecond time scale needed to analyze the happenings in the blast. The present paper aims to assess the performance of a blast with respect to the energy distributed around a blasthole and burden rock movement.

Keywords—Blast performance; Energy distribution; Burden rock movement; High speed camera

Coupled dynamic analysis of Spar-type floating wind turbine under different environmental conditions

KALYAN KUMAR KALUTLA
Department of Applied Mechanics & Hydraulics National Institute of Technology Karnataka, Surathkal Mangaluru, 575025, India. Email Id: *kalyan80967@gmail.com*

D. KARMAKAR
Department of Applied Mechanics & Hydraulics National Institute of Technology Karnataka, Surathkal Mangaluru, 575025, India. Email Id: *dkarmakar@nitk.edu.in*

Abstract— The present study deals with the coupled hydrodynamic analysis of 5-MW offshore spar-type floating wind turbine under different environmental conditions using time domain aero-servo-hydro-elastic code along with the wave load response simulation. The Response Amplitude Operator (RAO) of the spar-type floating wind turbine in all 6-DoF are predicted, compared and analyzed for different conditions of wind speed and wave height. The responses are obtained from the FAST code and the studies are performed to understand the stability of the structure under the environmental forces. The platform forces and moments are also obtained and the transfer functions for these responses are evaluated using aero- servo-hydro-elastic simulation.

Keywords: Spar-type floating platform; FAST; Floating offshore wind turbine; Response Amplitude Operator (RAO); Environmental conditions.

Numerical Investigation of Spar-type Floating Wind Turbine Combined with Wave Energy Converter

K. CHAITANYA SAI
Department of Applied Mech. & Hydraulics National Institute of Technology Karnataka, Surathkal, Mangaluru, 575025, India. cchaitanyasai10@gmail.com

AJAY H. PATIL
Department of Applied Mech. & Hydraulics National Institute of Technology Karnataka, Surathkal, Mangaluru, 575025, India. ajaypatil0308@gmail.com

D. KARMAKAR
Department of Applied Mech. & Hydraulics National Institute of Technology Karnataka, Surathkal, Mangaluru, 575025, India. dkarmakar@nitk.edu.in

Abstract — The present study deals with the coupled dynamic analysis of 5MW offshore floating wind turbine supported by spar platform combined with heave-type large point absorber wave energy converter system to study the motion behaviour of combined concept under operational conditions using time domain aero-servo-hydro-elastic code along with the wave load response simulation. The responses in all 6-DoF are predicted, compared and analysed for different wind speed and wave height. The responses are obtained from the FAST and the studies are performed to understand the stability of the structure. The platform forces and moments are also obtained and the transfer functions for these responses are evaluated using aero-servo-hydro-elastic simulation.

Keywords— Combined energy platform; FAST; Floating offshore wind

Performance Evaluation of Electrocoagulation Technique for Dairy Wastewater Treatment Using Aluminium Electrodes in Monopolar connection

Sanjay.S
Assistant professor, Department of civil Engineering,
Alva's institute of Engineering and Technology,Moodbidri
sanjay.sjce@gmail.com

Akshata M Chavan
UG Scholar, Department of civil Engineering
Alva's Institute of Engineering and Technology,Moodbidri
akshatachavan888@gmail.com

Abstract— The dairy business is a standout amongst the most contaminating of industries, not just regarding volume of profluent generated, but likewise in terms of its qualities as well. Dairy effluents break down quickly and exhaust the broke down oxygen dimension of the getting bodies. Dairy effluents contain dissolvable organics. The motivation behind this examination was to explore the impact of parameters, for example, connected voltage, detention time on electrocoagulation process for dairy wastewater treatment utilizing aluminium electrodes. It is seen that the expulsion effectiveness of BOD, COD, TDS, Nitrates, phosphates and oil and oil expanded with increment in the connected voltage. The outcomes show that electro coagulation is proficient and watched evacuation efficiencies are 78.51%,81.08%,75%,93%,90.28% and 75% of BOD, COD, TDS, Nitrates, Phosphate and oil and oil individually for 75 minutes of treatment under a consistent voltage of 15V.The analyses exhibited the adequacy of electrocoagulation method for the treatment of journal wastewater.

Keywords— Diary wastewater, Aluminium electrodes, Electro coagulation, DC power supply.

Mechanical properties of circular and square steel hollow pipes under tension

ManjushaSalunkhe
Dept. of civil engineering annasahebdange college Of engineering Ashta, India
salunkhemanju2009@gmail.com

Prof. Vidya Patil
Dept. of civil engineering annasahebdange college Of engineering Ashta, India
vmp_civil@adcet.in

Abstract— In most of the steel structures steel pipes are used for the construction. The steel pipes are used as per the different requirements for example as compression member and flexural member in small structures. After certain period steel pipes loses its strength due to many reasons like earthquake, rusting, shakes by machine etc. in that case structure required the repairing of the pipes. There is lot of research work going on the rehabilitation of old steel structures. For any type of research testing of the material of pipes is required. There is standard procedure to calculate the tensile test for the material of steel pipe. This paper explains the methodology of material testing of steel structures. Paper includes the preparation of the test pieces of circular and square both steel pipes used. For testing YST 240 and IS 360 steel pipes are used. In this test sample pieces from the pipes are cut. With the use of universal testing machine test pieces are tested under tensile loading. The results are compared to the standard values which are approximately same. The paper also includes the graphical representation and calculation related to tests.

Keywords— hollow steel pipes, tensile test, mechanical properties

ANALYSIS OF RCC STRUCTURES SUBJECTED TO SPATIAL BLAST LOADING

Payal Kadam
Research scholar, Department of civil engineering, Ashta, India pylkdm@gmail.com

Vidya Patil
Assistant professor, Department of civil engineering, Annasahebdange college of engineering &tecvhnology, Ashta, India

Abstract—The principle of building design is to achieve the assigned objectives under the prescribed demand. Cases of large-scale damages to structures due to unpredictable, higher levels loading, arising out of environmental loading; blast loading is one of them. The purpose of this research is to calculate blast parameters by analytical approach and obtain the pressure variation on different faces of building using IS:4991-1968. Three explosion weights (100 kg , 500 kg & 1000 kg) are exploded in three different standoff distances (15m , 30m & 45m) & at 0m , 6m & 12m vertical in air. Blast parameters & pressure variation on different faces of building are calculated for different explosive weights & respective distances.

Keywords—Explosion, terrorist attack, blast parameter, spatial blast loading

Anaerobic co-digestion of herbicide 2,4-dichlorophenoxyacetic acid with starch and post treatment in aerobic reactor and identification of dominant bacteria

G. B. Mahesh
Civil Engineering Dept., NITK, Surathkal Mangaluru, India gbcmahesh@gmail.com
Basavaraju Manu
Civil Engineering Dept., NITK, Surathkal Mangaluru, India
bmanu8888@gmail.com

Abstract—This study was conducted to investigate the new method comprising of sequential anaerobic followed by aerobic batch reactor treatment for 2,4-dichlorophenoxyacetic acid (2,4-D). The various parameters influencing on the anaerobic digestion like pH, temperature, oxidation reduction potential (ORP) have been monitored during the 60 days study period. pH range of 6.5 – 7.2, temperature greater than 31.4 oC and ORP values of between -250 to -300 have reported better reactor performance with high 2,4-D removal and biogas gas production. The complete biotransformation of 2,4-D in the anaerobic reactor indicated by disappearance of intensity peak in the high performance liquid chromatograph (HPLC) report, high biogas production of 12 – 18 % than control and COD removal efficiency of 99 %. Dominant bacterial community in the sludge was identified using SEM images. The results of this study indicate that anaerobic reactor and aerobic post treatment method can make the treatment highly efficient.

Keywords— 2,4-d; anaerobic co-digestion; aerobic mineralization; biotransformation

Performances of surface circular footings on unreinforced and reinforced flyash beds subjected to static loads

H. C. Muddaraju
Civil Engineering Department, University Visveshwaraiah College of Engineering,
Bangalore-560056, Karnataka, India
muddu.hc@gmail.com

***Abstract*—** A large number of reinforced soil structures have been constructed throughout the world. Compared with the traditional gravity soil structures, Geosynthetics reinforced soil structures have better engineering characteristics such as light deadweight, beautiful shape, construction convenience etc. Especially on soft grounds, the better performances would be obtained in virtue of their light deadweight. Characteristics of the filling materials and their interface friction properties with the geosynthetics directly influence the performances of the geosynthetics reinforced structures. A filling material of geosynthetics reinforced soil structures should have the engineering properties such as, good mechanical properties which include the strength and rigidity, better interface friction property with the geosynthetics and should better be lightweight. The use of waste materials as fill for reinforced soil structures is desirable from an environmental as well as economic point of view. Coal based thermal power stations produce massive quantities of coal ash. There are mainly two types of ashes which are produced by burning the coal. The lighter one that goes up the chimney and collected either by mechanical or by electrostatic precipitator, is known as Flyash. The other fraction which contains coarser materials and is collected at the bottom of the furnace, is known as bottom ash. Flyash forms almost 90 % of total coal ash and poses serious environmental problems. The use of stabilized flyash as a light weight fill in construction is common. The material can also be used in reinforced soil structures.Flyash is produced in millions of tons and the environmentally acceptable disposal of this material has become an increasing concern. Keeping this point in view the researchers started making use of flyash in construction works. Quality construction materials are not readily available in many locations and prove costly to transport over long distances. Hence, over the last few years, environmental and economic issues have stimulated interest in development of alternative materials that can fulfil design specifications. The use of flyash as backfill material fulfils the requirements and efficient draining. When flyash is provided with reinforcement it solves two problems. i.e., elimination of solid waste problem on one hand and provision of a needed construction material on other. The laboratory experimental results reported by various researchers and the field reports where flyash is being used as a backfill has proved beyond doubt that fly ash is an effective alternate for the backfill. Guided by this in the present investigation it is aimed to study the effectiveness of reinforced flyash beds under monotonic loads. Laboratory monotonic load experiments are conducted on reinforced flyash beds by varying the reinforcement parameters and the loading pattern.

Keywords— Reinforced fly ash bed, Static loads, Bearing capacity ratio, settlement ratio, geogrid, circular footing,

Effectiveness of Base Isolation using Single Friction Pendulum in Plan Irregular Structures

Sharika R
Dept. of Civil Engineering NITK Surathkal Mangalore, India sharika.r96@gmail.com

Katta Venkataramana
Dept. of Civil Engineering NITK Surathkal Mangalore, India ven.nitk@gmail.com

Abstract— Base isolation is found to be a very efficient earthquake resistant construction method. When base isolation is introduced, the transfer of large amount of inertia forces are prevented by the moving action of an isolator during an earthquake. The application of base isolator in regular buildings is done from long before, but the usage and effectiveness of base isolation in irregular buildings is a topic which needs more research. In this study, Single Friction Pendulum isolator is used to isolate the buildings and the effectiveness of isolators is discussed in regular as well as plan irregular buildings. Modal analysis and Time History analysis using Chi-Chi earthquake accelerogram data is done. Time period obtained from modal analysis and the results of time history analysis such as, base shear, storey acceleration and storey drift of regular as well as plan irregular buildings are compared. The time period is found to increase significantly and base shear, acceleration and storey drift are decreased significantly with the application of single friction pendulum isolator. Also the effectiveness of isolator got reduced with the introduction of irregularity in the structure.

Keywords—base isolation, single friction pendulum isolator, modal analysis, time history analysis, accelerogram.

Removal of Heavy Metals from Synthetic Mine Drainage in Lab-Scale Constructed Wetlands

Blesson S
M.Tech student Dept. of civil engineering NMAMIT, Nitte Karnataka, India
sblesson2@gmail.com

Pusparaj A Naik
Assistant professor Dept. of civil engineering NMAMIT, Nitte Karnataka, India
pushparajmanai@nitte.edu.in

Prof. Satoshi Soda
Dept. of Environmental affiliation Ritsumeikan University Biwako- Kusatu Campus Shiga Prefecture, Japan soda@fc.ritsumei.ac.jp

Abstract—The most toxic pollutants in mine drainage are heavy metals. The JOGMEC Company are using a waste water treatment plant which is highly expensive to maintain. As for that reason they have thought of using Constructed wetland method for the removal of heavy metals form mine drainage. For this project, they have asked KANSO CO. LTD. along with Dr. Satoshi Soda and his team to conduct initial survey, which includes lab-scale analysis for removal of heavy metals. Synthetic mine drainage in lab-scale is to be treated using constructed wetland in a sequence batch to assess heavy metal removal efficiencies. This projects main intention is to reduce the cost for the maintenance of the treatment plant and to obtain the higher efficiency for removal of heavy metals.

Keywords—Constructed wetlands (CWs), synthetic mine drainage, heavy metals.

Removal of Toxic Metals from Synthetic Water Using Arecanut Peel as an Adsorbent

Prof.Venkatareddy B Koppad
venkateshbk043@gmail.com

Smt Kamala and Sri Venkappa M Agadi
College of Engineering and Technology, Laxmeshwar-582116, Gadag, Karnataka, India.

Dr. D S Viswanath
viswadkt@gmail.com
S.T.J. Institute of Technology, Ranebennur – 581115, Karnataka, India.

Dr.Palakshappa K
palakshappa@yahoo.com
P.A.College of Engineering & Technology, Mangalore – 574153, Karnataka, India.

ABSTRACT-Environmental issues have become serious social concerns of a global scale. Among these issues, the impact of water pollution is getting more serious because it is closely related to the health and lives of human beings. The removal or breakdown of toxic metals from wastewater is an important and integral part of any industrial chemical process.

Much attention has been made towards adsorbent materials to be used in heavy metal removal from polluted water and various techniques are applied such as chemical, physical and biological techniques. This study was designed for using less expensive and much frequently available materials (mango peels, Neem leaves & coconut husk) to remove iron, Led, copper and cadmium from water. Current data show that all adsorbents used are capable of removing Lead acetate and Cadmium sulphate at significant capacity by using Arecanut peel as an adsorbant. Experiments were carried out by varying the parameters like initial metal concentration, contact time, pH, adsorbent dosage and grades of adsorbents.

Keywords: Heavy metals, Adsorption, Removal Efficiency, Contact time, pH, adsorbent dosage.

Investigation of Swelling behaviour on expansive soil using Limestone calcined clay cement

Brijesh K. Agarwal; Shyam A. Hathiwala
Applied Mechanics Department SVNIT Surat, India
brijeshagarwal251@gmail.com ; shyamhathiwala@yahoo.com

Anand V. Reddy *Applied Mechanics Department SVNIT* Surat, India
vemulaanandreddy@gmail.com

Chandresh H. Solanki
Applied Mechanics Department SVNIT Surat, India
chandresh1968@yahoo.co.in

Abstract—In this paper an investigation is carried out to study the effect of a new ternary binder limestone calcined clay cement (LC3) in reducing the swelling characteristics of expansive soil as an alternative to cement stabilization. One-dimensional oedometer and modified free swell index (MFSI) tests were performed to examine the changes in the swelling behavior of soil mixed with different percentages binder LC3 (i.e. 4%, 6% and 8%). It was found that addition of 8% binder reduced swelling potential up to 90%. Besides, swelling pressure of the expansive soil reduced up to 66%. Empirical relations were developed to predict the swelling characteristics with the increase in binder content using exponential decay model with R2 = 0.99. Moreover, the time swell behavior of treated and untreated soils was observed to be hyperbolic curves which were used to predict the maximum swelling potential. The observations show that inclusion of binder at 8% replacement has a significant influence on swelling and cementation structure of (LC3) stabilized soil. The binder used in this study (LC3) has been found to be effective and economic in stabilization of expansive soils with lesser CO2 emissions during its manufacturing process.

Keywords—Supplementary cementitious materials, black cotton soil, swelling, limestone calcined clay cement.

Temporal Crop Monitoring with Sentinel-1 SAR Data

Shaik Salma
Postgraduate Scholar
Dept. of Applied Mechanics and Hydraulics
NITK Surathkal
Karnataka, India
Email: s.salma4268@gmail.com

B. M. Dodamani
Associate Professor
Dept. of Applied Mechanics and Hydraulics
NITK Surathkal
Karnataka, India
Email: bm.dodamani@gmail.com

Abstract—Spatial and temporal analysis of crops and other land surface features is the major application of present spaceborne sensors. Among most of the spaceborne sensors, Synthetic Aperture Radar (SAR) is having the advantage of all-weather capability with low frequency bands. SAR data is useful for decompositions, crop classifications etc. In this study, paddy fields are classified using Sentinel-1 ground range detection Synthetic Aperture Radar data with the combination of vertical polarization with the horizontal receiver (VV and VH) is selected for the temporal variation analysis and classification analysis of paddy fields along with the plantations. Multi-temporal classification analysis is done using random forest classifier, and correlation obtained is 0.78 and 0.45 in VH and VV polarization respectively, and the error rate shows significant variation in both the polarizations i.e., 0.05 and 0.25 (in VH and VV polarizations respectively), which indicates more error rate in VV polarization band. In this study area, VH polarization shows better classification and correlation compared to VV polarization due to double bounce effect of urban features, paddy and plantation at the stem elongation and booting stage in VV polarization.

Keywords—Synthetic Aperture Radar (SAR) data, multi-temporal analysis, crop classification

Trend Analysis of Monthly, Seasonal and Annual Rainfall in Kundapur and Vittal Regions in the State of Karnataka

Dr.Lathashri U.A
Associate Professor *Dept. of Civil Engineering Manipal Institute of Technology* Udupi, India
latha.ua@manipal.edu
Rouhin Mitra
B.Tech Student *Dept. of Civil Engineering Manipal Institute of Technology* Udupi, India
rouhinmitra@gmail.com
Ahmad Arsalan Khateeb
B.Tech Student *Dept. of Civil Engineering Manipal Institute of Technology* Udupi, India
ahmadarsalan.khatib@gmail.com
Peeyush Chauhan
B.Tech Student *Dept. of Civil Engineering Manipal Institute of Technology* Udupi, India
peeyushchauhan@outlook.com

Abstract—Global warming can be attributed to the increasing variability of climatic conditions such as rainfall, temperature, evaporation and other parameters in recent years. Trend analysis of these parameters helps reduce the uncertainty of the parameters and facilitates prediction with a certain amount of assurance. The study performs trend analysis of 57 years (1960-2016) of rainfall data of Kundapur region and 40 years (1971-2011) of rainfall data of Vittal region in the state of Karnataka using Mann- Kendall's method and Sen Slope Estimator at 5% significant level. The analysis was conducted on an annual, seasonal and monthly basis. The results revealed a downward significant trend in the rainfall in the monsoon season in Vittal and no significant trends in rainfall were observed on an annual basis in both Kundapur and Vittal.

Keywords— Trend, Precipitation, Rainfall, non-parametric test, Mann-Kendall, Sen's Slope, climate change, Karnataka

Minor Losses Due to Pipe Fittings

Parvathi K S
civil engineering *Assistant professor Dayananda Sagar College of Engineering*
Banglore, India.
ks.parvathi88@gmail.com

Vinitha Santhosh
civil engineering *UG Student Dayananda Sagar College of Engineering* Benngaluru, India
santhosh.vinitha@gmail.com

Harsha gowda N
A civil engineering *UG Student Dayananda Sagar College of Engineering*
Bengaluru, India
harshagowda2498@gmail.com

Abstract— In this paper "Minor losses due to various pipe fittings" a detailed study is made on head loss of two different pipe materials with various fittings such as elbow, sudden enlargement, and sudden contraction. Loses are caused due to various fittings and they can be determined by experimental set up and further solved with the help of Bernoulli's equation. We have determined the loss coefficient K due to different fittings and different pipe material. The loss of co efficient is determined from the experimental setup as it allows easy integration of minor loses into the Darcy Weisbach equation.

Keywords— Pipe flow, Pipe material, various fitting and Loss co- efficient

DEFLUORIDATION OF GROUNDWATER USING ELECTRO- COAGULATION FOLLOWED BY ADSORPTION

Deepthi B.P
Assistant professor
Dept of Civil Engineering
Dayananda Sagar Academy of Technology and Management
Bengaluru,Karnataka, India
deepthi.phalanetra@gmail.com

Shreyas B.V
Assistant professor
Dept of Civil Engineering
Dayananda Sagar Academy of Technology and Management
Bengaluru,Karnataka, India
shreyasbv2009@gmail.com

Dr. K N Vishwanath
Professor & Head
Dept of Civil Engineering
Dayananda Sagar Academy of Technology and Management
Bengaluru,Karnataka, India
vishukv@yahoo.com

Abstract: The present investigation aims at removing excess fluoride from spiked ground water to the BIS prescribed drinking water standards of 1.0 to 1.5 mgL-1 using Electrochemical Coagulation (EC) followed by adsorption. A set of batch EC experiments were conducted for varied initial F concentration, varied cell voltage by keeping a constant ET of 60 min. The optimum operating conditions were determined by running a series of batch experiments employing 6 number of electrodes at F0 = 5, 10, 15, 20 and25 mgL-1. The varying cell voltage of 8, 12, 18, and 24V were used. Batch EC studies revealed that, the highest treatment efficiency was obtained for the largest current input i.e. 24V. Fluoride concentration of 15 mgL-1 was found to be the optimum initial concentration with respect to maximum fluoride and solids removal. These optimum operating conditions were incorporated in the continuous treatment processes carried out at different flow rates and different depths of sand. It was observed from the continuous studies that with the increase in flow rate and there was decrease in the fluoride removal efficiency. Increase in the depth of sand increases fluoride removal rate as the surface area available for adsorption will be more. Flow Rate of 4lph and Depth of Sand as 45 cm showed maximum fluoride removal efficiency of 94.6%.

Keywords: Electrocoagulation(EC), Electrocoagulation time (ET), Cell voltage (V), Fluoride(F), Adsorption

Simulation & Control of a Biological Wastewater Treatment Process

Sanjith.S.Anchan
Ph.D Research Scholar *Chemical Engineering Department National Institute of Technology* Surathkal, India sanjithsj@gmail.com
Orcid No. 0000-0002-0075-1942

C. Sankar Rao
Assistant Professor *Chemical Engineering Department National Institute of Technology* Surathkal, India csrao@nitk.edu.in Orcid No. 0000-0002-3554-5006

Abstract— Wastewater is that water which has picked up various contaminants during its utilization in domestic, commercial or industrial applications. Since these days water source is undergoing deficit and to save the environment ecosystem the treatment of the used water (wastewater) is very crucial. Any wastewater treatment plant that treats wastewater from both municipality and industries having soluble organic impurities, have Physical, chemical and biological zone or stages of treatment except in few objective specific plants. Among these three stages, biological treatment conquers an integral and important part of any treatment plant. The main reason for this would be due to economic advantages, interms of operating cost as well as capital cost, when biological treatment is compared with other stages. A single stage biological wastewater treatment layout with dynamic control model is examined in this study. Manipulation of two sensitive variables that are substrate feed concentration and influent flow rate were performed according to deviation in the exit substrate concentration. Mathematical models for Biomass, Substrate and Oxygen concentration of aeration tank, and three levels of Biomass concentration model for settling tank were formulated and investigated for their impact on process control with a time delay function. To overcome the disturbance for implementing the feedback control system, the resulting model constitutes a simple input-output structure. Extensive simulation results reveal the high predictive quality of the linearized mathematical model. The study on two formulated unstable transfer function revealed the benefits of having a PID controller. This paper serves as a reference for future improvements in developing new advanced control techniques for wastewater treatment field that aims in abiding the stringent effluent quality standards.

Keywords—Wastewater Treatment, Activated Sludge Process, Control Engineering.

Comparative study on OPC and PPC composites with foundry sand as partial replacement for fine aggregate- An experimental approach

Dr.P.S.Raghuprasad
Associate Professor *Construction Technology andManagement JSSS&TU* Mysuru,India.,
psrsjce@gmail.com

Monish Kumar K
Construction Technology andManagement JSSS&TU Mysuru,India.,

Dharshan K.,
Asst Professor *Construction Technology andManagement JSSS&TU* Mysuru,India.,

Dimple.B
Construction Technology andManagement JSSS&TU Mysuru,India.,

Pallavi.K.B
Construction Technology andManagement JSSS&TU Mysuru,India.,

Abstract— For the last few decades, there is an enormous increase in the construction activities. In respect of these, there are many factors which have to be considered in order to make the construction project an ideal one. At present, due to simultaneous awareness increase on environment, energy and natural resources, increasing attention should be paid to the utilization of industrial by products in construction industry. Scarcity of natural resources, low bearing capacity of soils, economic design of structural elements, necessity of high raised buildings, disposal problems etc. are the main crunches which the construction industry is encountering at present. The paper focuses on the performance of concrete, where the fine aggregate is partially replaced with foundry sand. The experimental work has been carried out in different stages. M25 grade of concrete mix is chosen for the present study.

On fresh concrete workability tests such as slump, compaction factor and V-B tests were conducted and on hardened concrete compression test is conducted in accordance with BIS specifications. An attempt has been made to compare the results with that of the conventional concrete and also between concrete made with 43 Grade Ordinary Portland Cement Concrete and Portland Pozzolanic Cement Concrete. From the result of the present investigation it is evident that the performance of concrete with 20% partial replacement of fine aggregate with foundry sand is better than that observed for conventional concrete. Further it is observed that PPC concrete is performing better than OPC concrete at all levels of replacement.

Keywords— construction, energy, compaction, Pozzolanic, foundry Sand .

Experimental study on Partial replacement of cement and sand in concrete by ETP sludge

Dharshan.K,Dr.D.B.Nirmala,Dr.P.S.Raghuprasad,and MonishKumar.K

Assistant Professor, Construction Technology &Management,JSSS&TU,Mysuru,India (dharshanrck@sjce.ac.in)
Assistant Professor, Construction Technology &Management,JSSS&TU,Mysuru,India
Associate Professor, Construction Technology &Management,JSSS&TU,Mysuru,India
Assistant Professor, Construction Technology &Management,JSSS&TU,Mysuru,India

Abstract—A speedy growth of urbanization and industrialization causes various environmental problems due to improper management of waste materials. The waste produced by textile industry is known as Sludge from Effluent Treatment Plant (ETP). In this project the ETP sludge is used as partial replacement for cement & fine aggregate in concrete. This experimental investigation is carried out to evaluate the compressive strength of concrete. The textile mill sludge is partially replaced for Cement & fine aggregate in M20 grade of concrete. The concrete cubes of size 150X150X150 mm were casted with ETP sludge and compressive strength values of the cube is determined for 7 days and 28 days for different percentage of sludge in concrete. The concrete cylinders are casted and the split tension values are also determined.

Keywords: ETP Sludge, Compressive Strength, Compressive Strength, Split Tensile Strength

DEVELOPMENT OF SELF COMPACTING CONCRETE USING FLY ASH

Dr. Nirmala D B1, Dharshan2, Dr.Raghuprasad3,Monish Kumar K4, Pallavi K B5

1 Assistant Professor Construction Teghnology and management JSSS&TU Mysuru,India

2 Assistant Professor Construction Teghnology and management JSSS&TU Mysuru,India

3 Associate Professor Construction Teghnology and management JSSS&TU Mysuru,India

4 & 5 Construction Teghnology and management JSSS&TU Mysuru,India

Abstract— This paper presents the utilisation of flyash in developing self-compacting concrete mixes (SCC). Since SCC mixes requires very high powder content, flyash is used as a filler material and high range of superplasticizer Glenium B233 is used to improve the workability and Glenium Stream-2 VMA is used to enhance the cohesiveness of the SCC mix. In this study the mechanical properties of M30 grade self-compacting concrete containing both GGBS and foundry sand as partial replacements for cement and M-sand respectively are studied. The mix proportion for M25 SCC mix containingCement, Natural river sand, Coarse aggregates Fly ash as a filler material, Super-plasticizer and VMA is obtained by Nan Su method. In the design mix flyash is replaced for cement upto 30%. The workability in terms of slump flow and V-funnel tests are carried out on all SCC mixes. Further, the mechanical properties of all SCC mixes in terms of Compressive, Split-tensile and Flexural strengths are determined at 7and 28 days. The results indicate that SCC mix with 25% replacement of cement with flyashshows better results.

Keywords— Self compacting concrete, Modified Nan Su method, VMA, V-Funnel.

Impacts of dams on sediment yield and coastal processes using SWAT and DSAS tools

Athira K
Department of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India athirasreek@gmail.com
Arunkumar Yadav
Department of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India atyyadav@gmail.com
0000-0002-7641-738
Dr. B M Dodamani
Department of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India bm.dodamani@gmail.com
Dr.Dwarakish G S
Department of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India dwaraki.gs@gmail.com

Abstract— Soil erosion is considered as one of the major causes of land degradation and reservoir sedimentation. Therefore, modelling of runoff and sediment yield at the catchment level is necessary. In this study, an attempt was made to simulate runoff and sediment yield of hydrologically similar basins of Kali River and Aghanashini river which joins west coast of India. A conceptual, continuous time and semi-distributed, SWAT2012 (Soil and water assessment tool) model was selected for the modelling purpose. For the last two decades, Kali river basin experienced a very high rate of soil erosion due to various developmental activities in the basin. Therefore, it is essential to identify the soil loss within the basin. There are five dams constructed across the Kali river basin for various purposes. Presence of these reservoirs regulates stream flow and thus sediment load in the basin. However, the free movement of water across the Aghanashini river catchment leads to the unobstructed passage of sediments to the river mouth, as the catchment is not disturbed by the reservoir. This study deals with the impacts of the dams on streamflow, sediment load and the response of shoreline. DSAS (Digital shoreline analysis system) tool was used to analyze the shoreline changes. Simulated and observed values of runoff are compared, and calibration and validation were done for the basins using SWAT CUP. Analysis of calibration and validation results shows that the model has a good performance. Therefore, the SWAT model can be used to conduct further studies in these study areas. Sediment yield obtained at the catchment outlet was 1.07t/ha/year and 4.58t/ha/year for Kali and Aghanasini basins respectively. Less amount of sediment load in the Kali basin indicate the influence of reservoir operation on

streamflow and sediment yield. The shoreline analysis of both the basins concluded that Devbagh beach connecting with Kali river estuary is under erosion and Aghanashini beach is under naturally nourished condition.

Keywords— SWAT model, Streamflow, Sediment yield, Reservoir operation

Generation of Intensity Duration Frequency curve using daily rainfall data for Aghnashini river watershed, Uttara Kannada

Shivakumar J Nyamathi1
Professor, Civil Engineering department, UVCE, Bangalore University Bengaluru, Karnataka. shivakumarnyamathi@yahoo.com
Yashas Kumar H K2*
PG Student, Major Water Resources Engineering, UVCE, Bangalore University Bengaluru, Karnataka. Yashasu293@gmail.com

Abstract— Analysis of quantity of rainfall is needed for planning process and design process of various water resource projects. Intensity-duration-frequency (IDF) curves are used to analyze quantity of rainfall of different duration (t) and return periods (T). The study is carried out in Aghnashini river watershed which is located at 74o18'15.95"-74o55'22.84" E longitude and 14°15'26.21"-14°37'17.65" N latitude covering an area of 1400.47 sq.km and elevation ranges from zero meters to 784 meters above MSL. The river originates in Sirsi and flow towards West and reaches Arabian sea at Kumta of Uttara Kannada, Karnataka state. The daily rainfall data of nine stations collected from Directorate of Economics & Statistics Bengaluru for years 1998 to 2016 was gone through and 24-hour maximum annual rainfall data was extracted. Indian Meteorological Department (IMD) proposed formula is used to estimate rainfall values for various shorter duration such as 0.083, 0.167, 0.25, 0.5, 1, 2, 12, 24- hours. Probability distribution is used to estimate maximum annual rainfall values for various duration (t) and return periods (T) and Chi-Square test is carried out to check best probability distribution. Chi-Square test shows that Normal distribution is best fit to calculate rainfall intensity (mm/hr) for six stations (Balale, Nilkundi, Sirsi, Hittalahally, Tyagali, Katagal), Log-Pearson type Ⅲ probability distribution is best fit for two stations (Bandal, Siddapur) and Log-Normal distribution for one station i.e., Kumta in Uttara Kannada.

Keywords— IDF curves, Aghnashini River, IMD, Chi-Square test, Normal distribution, Log-Pearson type Ⅲ, Log-Normal

Review Paper on Behaviour of Cold-formed Steel sections under Axial Compression

Asim Bahadur
PG Student, Department of Civil Engineering AnnasahebDange College of Engineering and Technology Ashta, India ORCID- 0000-0002-4046-5983
Kiran Shinde
Assistant Professor, Department of Civil Engineering AnnasahebDange College of Engineering and Technology Ashta, India ORCID-0000-0002-8223-5297
Vidya Patil
Assistant Professor, Department of Civil Engineering AnnasahebDange College of Engineering and Technology Ashta, India ORCID-0000-0001-7382-0040

Abstract— Steel is used in construction industry due to its hardness and tensile strength. Cold-formed steel is type of steel which is manufactured at lower temperature. Cold form steel become more popular in twentieth century in civil engineering field as it possesses high strength to weight ratio and post-buckling strength. Research in Cold-formed steel have increased considerably in past few years. Researchers have been working to develop Direct Strength Method to replace Conventional Effective Width Method which is more tedious and less accurate. In This paper we have studied various methods adopted for estimation axial load carrying capacity of cold-formed steel channel, angle and Z sections by various researchers.

Keywords— Cold-formed steel, Channel Section, Angle Section, Z section, Effective Width Method, Direct Strength Method.

ANALYSIS OF ANCHORAGE ZONE STRESSES IN POST-TENSIONED CONCRETE GIRDERS

Dipindas C D *Former PG Student Dept. of Civil Engineering NITK Surathkal Karnataka, India*
Prashanth M H *Assistant Professor Dept. of Civil Engineering NITK Surathkal Karnataka, India*
Lakshmy P *Scientist F and Head Bridges and Structures Division Central Road Research Institute New Delhi, India*

Abstract— Application of pre-stressed concrete for the construction of civil engineering structures especially bridges has increased tremendously. In the pre-stressed post-tensioned concrete structures, anchorage zone is the critical area of concrete ahead of the anchorage device. During application and diffusion of the pre-stressing force in a post-tensioned girder tensile bursting stresses are developed at some distance ahead of the anchorage device in a region known as the general zone. This stresses often leads to serviceability problems and congestion of reinforcement at the anchorage zone. In this paper, a rectangular end block of 600 x 600 mm, with a bearing plate size of 214 x 214 mm, subjected to a concrete pre-stressing force of 2204 kN was analyzed using the methods like elastic method, deep beam analogy, Strut and Tie model approach, finite element analysis and also using the codal provisions specified in IRC: 18 and British code BS: 8110. From the analysis of 2-D finite analysis, it was observed that the variation of bursting stress in the end block is parabolic in nature. It was observed that with increase in eccentricity of bearing plate, there was a decrease in bursting tensile stress, whereas the value of spalling tensile stresses increases drastically. However, with increase in the size of the bearing plate, both the spalling and bursting stresses decrease considerably. It was also found that the grade of concrete has negligible effect on the distribution is of bursting tensile stress. The finite element analysis of anchorage zone with multiple anchors indicates that spalling stresses are more critical than the bursting stresses for the design of anchorage zone.

Keywords—pre-stressed concrete, anchorage zone, bursting tensile stress, spalling tensile stress

Assessing the Impact of Sea Level Rise on Dakshina Kannada Coast using RS and GIS

S B Gowthami
Dept. of Applied Mechanics and Hydraulics NITK, Surathkal Mangalore, India
siranagowthami@gmail.com
Dwarakish G S
Dept. of Applied Mechanics and Hydraulics NITK, Surathkal Mangalore, India
dwaraki.gs@gmail.com

Abstract— The rising sea levels increases the risk of flooding and causes considerable damage to coastal cities. The potentially inundated areas are analysed along Dakshinakannada coast in Karantaka. SRTM DEM is used for elevation and sentinel-2 data for preparing LU/LC map of seven classes. The flooded maps are produced for each of 1-5m sea level rise and also for 10m SLR. The drowned areas for 5m and 10m rise of water are 7.9 km2 and 20.6 km2. The degree of inundation of each LU/LC class is computed for 10m SLR scenario. Forests is the most effected class of land cover. Moreover, the most affected regions are beaches, estuaries, coastal plains and flood plains.The results obtained can be considered as primary reference by the local government for planning any further developmental activities along the coast.

Keywords—Sea level rise, Coastal flooding, Inundation, Land use/Land cover.

Strength Characteristics of Fly Ash Stabilized Silty Sand for Subgrade Application

Harish G R
Department of Civil Engineering *New Horizon College of Engineering* Bengaluru, India
gr.harish1@gmail.com
Javed Ali
Department of Civil Engineering *New Horizon College of Engineering* Bengaluru, India
javedali9945@gmail.com
Karan D Patil
Department of Civil Engineering *New Horizon College of Engineering* Bengaluru, India
karan.dp.8057@gmail.com

Abstract—Subgrade is an important component in the pavement structure. Ultimately, the stress due to self-weight of the pavement structure and traffic is transferred to the soil subgrade below. The performance and durability of pavement depends on the type of subgrade soil and its engineering properties. On site, while during construction the engineer is exposed to different types of soils and among them, some soils are considered problematic owing to their engineering properties and behavior under adverse conditions. Whenever, the problematic soils are encountered and it is unavoidable, it is essential to improve the mechanical properties of the soil. Stabilization is one of the methods of ground improvement techniques. In this present study, stabilization of one such problematic silty soil is carried out using class-C fly ash. A series of compaction, UCS and CBR tests were carried out. The fly ash dosage was varied from 0% to 25% with an increment of 5% and curing period of 3, 7, 14 and 28 days were considered. It is observed that the addition of fly ash resulted in increased UCS with an increase in fly ash content and curing period irrespective of the test condition. CBR of the fly ash stabilized soil increased from less than 2% to 11% over varying fly ash dosage. Overall, fly ash stabilization makes it possible to use unsuitable soil for subgrade application with modification and also, this technique addresses the issue of fly ash disposal providing eco-friendly environment.

Keywords—Silty soil, Class - C fly ash, UCS, CBR, Flexible pavement

Natural fibre reinforced soil block as a sustainable building material

Shimna Manoharan
Assistant Professor, Dept of Civil Engineering, BMSIT&M, India
shimnagm@gmail.com

Nazia Abdul Jabbar
Dept of Civil Engineering, SSET, Ernakulam India
naziaabduljabbar@gmail.com

Sona George
Dept of Civil Engineering, SSET, Ernakulam India
sonageorge432012@gmail.com

Abstract— Earth has been used in the construction of ancient houses for thousand years together with other natural materials such as wood and stone. The present study is conducted to determine the effectiveness of using different natural fibers that are abundantly available and cost effective along with a stabilising agent for improving the strength of earth block and also to find a proportion that gives maximum improvement in strength of the block by comparing them with unreinforced earth blocks which can give an economical and sustainable alternative building material. The natural fibres that are used in this study are straw and pandan leaves. Compressive strength and water absorption of fiber reinforced earth blocks by varying the percentages of fibers along with 8% cement was obtained. Laboratory results obtained positively suggest that inclusion of these natural fibre in earth block yielded a satisfying result.

Keywords - natural fiber, earth block, straw, pandan leaves, cement, water absorption and compressive strength.

TERRAZYME - A BIOENZYME SOIL STABILIZER SOLUTION FOR OPTIMUM PAVEMENT DESIGN

Chandana A S[1], Dr. B.V. Kiran Kumar[2], Shriram Marathe[3]
chandanaarunkumar22@gmail.com, kiran_kumarbv@yahoo.com, ram.nmamit@gmail.com
[1]Student, Post graduation (M.Tech in Construction Technology),
Department of Civil Engineering, NMAM Institute of Technology. Nitte, Karkala Taluk-574110, India
[2] Associate Professor Department of Civil Engineering, Govt.SKSJTI Engineering College. K.R Circle, Bangalore-560001, India
[3] Assistant Professor Department of Civil Engineering, NMAM Institute of Technology. Nitte, Karkala Taluk-574110, India

Abstract— The Pavement is a structure, which is laid to support the wheel load and to spread the load stress to a wider area on the top of soil subgrade. The process of changing the physical, chemical, and biological property of a natural soil, in order to improve their tensile strength, bearing capacity and overall performance, by using controlled compaction, proportioning, in addition of suitable stabilizer and admixture is known as stabilization of soil. The major application of soil stabilization is in the field of pavement set up over a weak subgrade soil. It is very much essential to improve its strength, bearing capacity and performance to a level higher than the existing condition. By modifying the subgrade soil properties, the economy can be achieved in pavement construction by having reduced upper crust thickness. The main objective of this work is to have an economical pavement design. In this study the type of soil used is silty sand (SM), and for stabilization of soil TerraZyme was used. After stabilizing the soil by using TerraZyme there was a marked improvement in compaction property, California Bearing Ratio (CBR) value, Unconfined Compressive Strength (UCS) value, Cohesion value and angle of intersection. The pavement thickness was designed by using IRC:37-2018, after stabilization of soil the thickness of pavement was reduced.

Keywords— Subgrade, Stabilization, TerraZyme, California Bearing Ratio, Unconfined compressive strength.

Flow duration curve modeling for sub-catchments of upper Cauvery basin

Dr.Chandre Gowda C
Department of Civil Engineering C. I. I. R. C. Jyothy Institute of Technology Thathaguni, Bengaluru:560082
email:chandregowac@gmail
comorcid-id: 0000-0003-1286-1601

Dr. B. C. Kumar Raju
Department of Civil Engineering A. C. S. College of Engineering Kambipura, Mysore road, Bengaluru:560060 email: kumarrajubc@gmail.com

Abstract — Planning, design and control of water resource systems desires reliable and longer duration runoff series. Establishing rainfall-runoff relationship is very significant in hydrological modeling, varying from its simple form (unit hydrograph) to complex models (dynamic flow equations). Models are generally used as utility in various areas of water resource development, assessing the available resources and determining the impact of external interference (such as land-use change or construction of hydraulic structures). In the present study the modeling of flow duration curve has been carried; probability of exceedance and percentage of reliable flow for the catchments were calculated. Stream flows from Kudige, K. M. Vadi, Akkihebbal catchments of Upper Cauvery basin, Karnataka, India was considered. The statistical tests were conducted to determine the performances. The result shows that the modeled flows were almost equal to the observed flow for Kudige and Akkihebbal sub-cathcments; minimum difference was observed for K. M Vadi sub-catchment (between 10% to 90 % exceedance probabilities).

Keywords—Flow Duration Curve, Exceedance of Probability, Streamflow modeling, Reliable flow, Modeling.

Seismic Analysis of braced And Unbraced Steel Frame Structure Using Shake Table

Amol Mali
Department of civil Engineering AnnasahebDange College Of Engineering & Technology
Ashta, MH, India amolmali405@gmail.com

Prof. Rajiv Chavarekar
Department of civil Engineering AnnasahebDange College Of Engineering &Technology
Ashta, MH, India
rrc-civil@adcet.in

Prof.MaheshBhanuse
Department of civil Engineering AnnasahebDange College Of Engineering & Technology
Ashta, MH, India Maheshbhanuse07@gmail.com

Abstract— This paper explores Effects of dynamic analysis on the prototype bracing and without bracing steel structure. The modern growing world trend inclination towards earthquake resistant structures. The braced frame can resist large amount of lateral force and have reduce lateral deflection. The (G+4) storied prototype with and without Bracing Steel Structure was modelled and tested with help of shake Table. To study experimental analysis and to study the parametric change due to bracing and without bracing steel structure. In experimental analysis various seismic properties as like, Acceleration Velocity, Displacement, Drift, Drift ratio, and other seismic properties.

Keywords— *Dynamic analysis, Shake table, bracing and without bracing steel structure model.*

Identification of potential sources affecting fine particulate matter concentration in Delhi, India

Harsha K
Department of Applied mechanics and hydraulics
National Institute of Technology, Surathkal, Mangalore, India
harshak27@gmail.com

S M Shiva Nagendra
Department of Civil Engineering
Indian Institute of Technology, Madras Chennai, India
snagendra@iitm.ac.in

Paresh Chandra Deka
Department of Applied mechanics and hydraulics
National Institute of Technology, Surathkal, Mangalore, India
dekanitk@gmail.com

Abstract— The seasonal air transport pathways and the potential sources contributing to air pollution in Delhi for the period March 2015 to February 2016 have been identified with the help of PM2.5 data (particulate matter with diameter less than 2.5 micrometers), Potential source contribution function (PSCF), cluster analysis and concentration weighted trajectory (CWT) method. The local sources are identified with the help of conditional probability function (CPF). The presence of re-circulating air masses has shown that the major contributors to air pollution in winter seasons are the local sources and the neighboring states of Haryana and Punjab. North westerly flows can be observed throughout the year and are highest in the winter season and comparatively lower in the monsoon season. PSCF values greater than 0.7 and CWT values greater than 110 μgm−3 are observed within the state in the winter season. Haryana and some parts of Uttar Pradesh also have higher PSCF values. The frequency of occurrence of long distance pathways are less in all the seasons in Delhi. The influence of the dust pathways from the Thar desert areas can be seen in the monsoon season. Slower moving north westerly and south westerly flows are associated with high concentration values and indicate high pollution along the pathways. Higher CPF values occur in the north eastern direction. Therefore the industrial sites, traffic congestion and emission from vehicles in the roads connecting Delhi and Uttar Pradesh has high influence in the rise in pollution levels.

Keywords—transport pathways, potential sources, PSCF, CWT, CPF, $PM_{2.5}$

Evaluation of CHIRPS satellite rainfall data-sets over Kerala, India

Divya P
Department of Applied Mechanics and Hydraulics
National Institute of Technology, Karnataka, India
divyap2525@gmail.com

Prof. Amba Shetty
Department of Applied Mechanics and Hydraulics
National Institute of Technology, Karnataka, India
amba_shetty@yahoo.co.in

Abstract— Climate Hazard Group Infrared Precipitation with station data (CHIRPS) is one of the latest high-resolution quasi-global satellite-based rainfall datasets. It is available in daily, pentadal and monthly time scale from the year 1981 to present. In the present study performance of the CHIRPS product is evaluated over the Kerala state on a monthly time scale. For the evaluation of this Climate Hazard group product rain gauge data from sixty-seven-gauge stations which are distributed all over Kerala was used. Validation statistics such as mean absolute error (MAE), multiplicative bias (Mbias), Nash Sutcliffe efficiency (NSE) and coefficient of determination (R2) were used for the evaluation. The results show that the efficiency of this satellite rainfall estimate is very high with an overall NSE value of 0.72. the accuracy of CHIRPS data was very high mainly in the low-lying areas of Kerala i.e. at the coastal areas and it was found to be decreasing when in approaches towards the Western Ghats. Overall CHIRPS product is good enough for use in water resource applications in Kerala.

Keywords—precipitation, satellite-based rainfall data, CHIRPS, evaluation

FLOOD INUNDATION MAPPING AND FLOOD HAZARD MAPPING USING GIS TECHNIQUES AND HEC-RAS MODE

Devanand M.R.
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka Mangalore, India
devanandastro@gmail.com

SubrahmanyaKundapura
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka Mangalore, India
subrahmanyakundapura@gmail.com

Abstract— Flood is the most common hydrologic event frequently experienced in India. The states of Kerala, UP, West Bengal, Karnataka and Assam were the mainly affected by flood in 2018. In Kodagu, the southern district of Karnataka, many people have been affected by heavy rains. Landslides in hilly terrain and flooding has worsened the lives of people and led to the destruction of 800 homes, 240 bridges collapsed, road networks of 2225 km damaged and 65 government buildings affected. The cost of rebuilding road infrastructure and buildings is approximately Rs.3000 crores. While developing flood mitigation measures, flood inundation maps are an essential component, which will be useful for the planning stage. The mapping is expected to estimate the prone flood zone based on river flood pulse stage without performing additional simulations, and quantification of the flood risk with respect to different vulnerability parameters giving a clear picture of the planning stage. These are going to be achieved by both 1D hydrodynamic models and GIS environment. This study gives an insight about how unscientific development activities may increase the negative impacts of natural disasters. It can support the planners to correctly identify the non-vulnerable places while rebuilding the damaged infrastructure. This can help people to resettle permanently in a safer place, so that they will not be affected in the case of future disasters. Depending on the severity of the water levels, we can identify the area for construction of prospective hydraulic structures for flood protection.

Keywords— hydrodynamic, flood risk, flood inundation.

Performance evaluation of Stone Mastic Asphalt incorporating Sugarcane Bagasse Ash

Ganesh G O
M. Tech in Construction Technology
NMAM Institute of Technology Nitte, Karnataka
ganesh03go@gmail.com

Roshan Rai
Assistant Professor in Department of Civil Engineering
NMAM Insitiute of Technology Nitte, Karnataka
roshanrai@nitte.edu.in

Abstract— Stone Mastic Asphalt (SMA) is a gap graded asphalt mix consisting of high coarse aggregate content and rich mastic (asphalt and filler) content. The stone to stone contact between coarse aggregates results in higher rut resistance compared to other asphalt concrete mixtures. The rich mastic in the SMA Mix leads to increased durability and higher resistance to moisture damage. Due to higher asphalt content and stabilizing additive used in the production of SMA Mix leads to increase in production cost which is one of the major disadvantage. This research evaluated the performance characteristics of SMA incorporating Sugarcane bagasse ash (SBA) as a filler material and to study the cost effectiveness. Four mixtures with different proportions of SBA used to assess the performance of the SMA. Mix 1 consisted of 2.5% SBA, Mix 2 consisted of 5% SBA, Mix 3 comprised of 7.5% SBA and Mix 4 consisted of 10% SBA by total weight of the mix. The resistance to moisture damage of Mix 1 and Mix 2 were within the allowable limit and indirect tensile strength of Mix 1 and Mix 2 were higher compared to conventional mixes. Decreased drainage of bitumen for SMA mixtures without fibres containing SBA were observed. The results obtained show that the mix containing up to 5% SBA exhibited superior performance when compared to conventional mixes.

Keywords— Stone Mastic Asphalt, Sugarcane Bagasse Ash, Indirect Tensile Strength, Draindown.

A case study on implementation of Lean in Precast construction

Lekha Shankar G R
PG Scholar
Department of Civil Engineering
NMAM Institute of Technology, Nitte, Udupi, India
lekhashankar1995@gmail.com

Janakaraj M
Assistant Professor
Department of Civil Engineering
NMAM Institute of Technology, Nitte, Udupi, India
janakaraj@nitte.edu.in

Abstract--The implementation of lean construction principles in precast casting is achievable when applied in a strategic way. Lean construction focuses on improving productivity and providing value to the customer. This paper aims to know the factors which influences the schedule of the precast project. It aims to suggest a change in process in the casting yard, by instigating "Lean tools & principles" to improve daily productivity in precast casting yard. A lean tool by name "Value Stream Mapping" is put forward to consider, to bring changes in the casting yard, mainly for casting box girders. Value Stream Mapping is a diagrammatic tool, which results in creating Current State Map of the casting yard showing each process, which lags the work to attain daily target. It identifies Value added and Nonvalue added activities, which causes delay in the work is identified. Lean tools are proposed, in order to reduce non-Value added activities, this change in the process and result obtained is seen by observing TAKT time, lead time. A Future State Map is drawn from the changes put forward in the Current State Map. From Value Stream Mapping(VSM), lead time was reduced from 11 days to 9 days, Non-Value added activity time from 7 hours to 1 hour 15 Minutes.

A Monte Carlo Simulation model is generated to get the probability of certainty of results in field.

VSM in improving the process from beginning to end by bringing down percentage of non-Value added activities which is resulting in delay in the work. This assists in attaining daily target in casting yard & improves daily productivity.

Key words: Lean construction, Precast technology, Value Stream Mapping.

THE IMPACT OF BUILDABILITY FACTORS ON FORMWORK IN RESIDENTIAL BUILDING CONSTRUCTION

Sona M
PG Scholar, Construction Technology,
Department of Civil Engineering
NMAM Institute of Technology, Nitte, Udupi, India
sonamariswamy@gmail.com

ABSTRACT-Improving productivity, increasing output for the same inputs, has been a longstanding concern of the Construction Industry. The different approaches to improving labour productivity in formwork will be briefly explained. The influence of the buildability elements on formwork labour out of key in situ reinforced concrete factors such as foundations, walls, columns, beams and slabs are yet to be gritty and quantified. The key results of several questionnaire surveys will be presented and the major deterrent to improve buildability and by which buildability problems are being overcome are identified.

Key words: formwork, labour productivity, buildability factors, construction industry, concrete elements

Influence of STP treated and reed bed treated domestic wastewater on properties of mortar and concrete mixes

Pushparaj A. Naik[*1*], Udayakumar G[2], Srinath Shetty K[3]
Civil Engineering Department,
NMAM Institute of Technology Nitte-574110, Udupi District, India
*Corresponding Author, e-mail:pushparajmanai@nitte.edu.in

Abstract—Polishing pond with gravel bed was constructed and planted with Canna generalis plants for treating the effluent from conventional domestic wastewater treatment plant. Raw sewage, treated effluent from S T P (Sewage Treatment Plant) and effluent from polishing pond were taken for analysis. Standard consistency, Early setting time and Compressive strength of cement, Slump and Compressive strength of concrete were determined using normal tap water, treated effluent and polished effluent. From analysis of effluents, it is seen that, characteristic values obtained for various parameters (for all wastewater types) are well within the acceptable limits as per water quality standards of BIS (Bureau of Indian Standards) for construction practice. There is clear reduction in normal consistency and initial setting time values for treated effluent and polished effluent as compared to normal tap water. An increment of 29% in 3 day compressive strength of cement has been observed for combination of polished water casting-fresh water curing as compared to fresh water casting and curing. For 7 and 21 days of curing, treated water casting-fresh water curing combination gives an increment of 16% and 11% in compressive strength as compared to fresh water casting and curing respectively. For increase in w/c ratio's lower slump values have been observed for treated water and polished water as compared to fresh water but except for w/c ratio of 0.6 for polished water. With 0.6 w/c ratio for polished water, little higher value of slump has been noticed when compared to fresh water. Though 7 days compressive strength of concrete for polished water castingfresh water curing is 40% more than fresh water casting-fresh water curing, the 28 days strength for both of these cases are almost same. It is observed that for longer duration of curing of 90 days, all combinations are giving almost same compressive strength of concrete. Cubes casted with treated water, cured with fresh water shows slower development of strength at early ages, but for 90 days of curing shows higher strength than fresh water casting-fresh water curing.

Keywords— reed bed, sewage treatment plant, wastewater, Canna genaralis, mortar and concrete

Hydrological Modeling of stream flow over Netravathi river basin

Ashish S
Post Graduate Scholar, Department of Applied mechanics and Hydraulics
National Institute of Technology Karnataka, Mangalore, India
ashish.shankar0894@gmail.com

SubrahmanyaKundapura
Assistant Professor, Department of Applied mechanics and Hydraulics
National Institute of Technology Karnataka Mangalore, India
subrahmanyakundapura@nitk.edu.in

VadivuchezhianKaliveeran
Assistant Professor, Department of Applied mechanics and Hydraulics
National Institute of Technology Karnataka Mangalore, India
vadivuchezhian_k@yahoo.co.in

Abstract— Riverine resources which are the basis of life are being transformed through urbanization. This has to be analyzed effectively in order to rejuvenate riverine ecosystems. The effects of land use dynamics are a factor to be analyzed and by using Hydrological modeling which is adopted in this study aids for the same. Soil & Water Assessment Tool (SWAT), is used as an effective tool in modeling the river basin due to its ability to quantify the alternate input data provided to the model. 14 year daily data was simulated in the model provided the warm-up period for the model is 2 years. Coefficient of determination value of 0.74 and Nash-Sutcliffe Efficiency (NSE) to be 0.71 was obtained from the analysis, indicates the simulated values fall within a good range. The parameters which influence most are found to be curve number, available water capacity in the soil, groundwater delay, Manning's n, plant uptake compensation. The fitted range was obtained and this was used to increase the accuracy in SWAT Calibration and Uncertainty Procedures (SWAT-CUP). Sequential Uncertainty Fitting ver.2 (SUFI2) was found to be effective because of its uncertainty consideration criteria, it accounts for all uncertainties that may occur in the mode. Hydrological modeling of a river basin can help us to assess the impact of alternative input data on the stream flow.

Keywords—SWAT, Hydrological, Modeling, Netravathi, Stream flow

Crop Suitability Analysis for Kabini Command Area Using RS and GIS Techniques- A Multi Criteria Approach

M. Shivaswamy
Research Scholar, Dept. of Civil Engineering,
R V College of Engineering, Bangalore 560059
Karnataka, India.
(Email: m_shivaswamy@yahoo.co.in)

A. S. Ravikumar
Professor, Dept. of Civil Engineering
UVCE, Jnanabharathi, Bengaluru 560 056
Karnataka, India.
(Email: profasrk68@gmail.com)

B.L. Shivakumar
Professor and Head, Dept. of Civil Engineering
JnanaVikas Institute of Technology Bidadi, Ramanagara 562109
Karnataka, India
(Email:drshivkumarbl@gmail.com)

Abstract - Water and land are the finite natural resources to be utilised for their optimum productivity. The management of these resources for sustainable development is the need of the hour. The modern techniques such as Remote Sensing (RS) and Geographic Information System (GIS) are used for creation of digital data base of different thematic maps require to assess the land suitability for different crops based on the land suitability. The suitability of land is assessed considering the cropping system, for optimizing the use of piece of land for a specific use (FAO, 1976). The suitability is a function of crop requirements and land characteristics and it is a measure of how well the qualities of land unit match the requirements of particular form of land use. The study area chosen is Kabini Command spreads in Mysuru and Chamarajnagara districts. It is geographically located between 760 12' 0'' E and 770 12' 0'' E longitude and 110 58' 0'' N and 120 16' 0'' N with an area of 707.284 km2 and is covered in Survey of India (SOI) Toposheet numbers 57H04, 57H03, 57D16, 58E01, 58A13, 57D12, 57D08, 58A05 and 58A01 on 1:50000 scale. RS and GIS techniques are used to delineate the command area, watersheds within the command and preparation of different thematic maps. Analytic Hierarchy Process (AHP), RS and GIS have shown as an efficient tools to derive the crop suitability within the command area.

Keywords - Land suitability, Analytic Hierarchy Process (AHP), Remote sensing, GIS, Thematic maps.

Performance Evaluation of Deep beams using Self-compacting concrete mixes

MANJUNATH R[1], MATTUR C. NARASIMHAN [2], UGWAL PRAKASH [3]
Research Scholar[1], Professor[2], Graduate Student[3]
Dept. of Civil Engineering,
National Institute of Technology Karnataka, Surathkal Mangalore, India.
rmanju301@gmail.com,mattur.cn@gmail.com

Abstract — The current research aims at studying the behaviour of reinforced deep beams made of SCC mixes with different shear span to depth ratios. SCC mixes of M-30 grade were proportioned using 12.5mm downsize jelly and river sand as coarse aggregate and fine aggregate. The deep beams were designed as per IS 456:2000. All the trial mixes were subjected to different flow ability tests in order evaluate their selfcompacting property of concrete as per the EFNARC guidelines. Test results concluded that the failure observed was primarily due to shear and the diagonal cracks were formed till the support starting from the loading point, due to diagonal compression.

Keywords— Reinforced Deep beams, Self-compacting concrete, shear span to depth ratio.

Comparitive study between chemical admixtures and bacterial admixtures in concrete

Likhit M L
Dept of Civil Engineering
Vemana Institute of Technology
Bangalore, India
likhit.ml@gmail.com

Preethi Suvarna
Dept of Civil Engineering
University Visvesvaraya College of Engineering
Bangalore, India
Suvarna.preethi72@gmail.com

Dileep Kumar U
Dept of Civil Engineering
A J institute of technology
Mangalore, India
dileepkumaru89@gmail.com

Abstract—Materials scientists, chemists, engineers, and manufacturers' technical representatives have helped the concrete industry to improve our ability to control work times, workability, strength, and durability of Portland cement concrete by adding some supplementary substances named admixtures. The function of each admixture focuses on a specific need, and each has been developed independently of the others. Some admixtures already have chemistry that affect more than one property of concrete, and some have simply been combined for ease of addition during the batching process. To better understand recommended usage for various application of these chemicals ad mixture in concrete, the present study is planned to be obtained more specific information in this direction. In this project an attempt is made to study the effect different admixtures such as Accelerator, retarders, water reducers and workability modifiers on the properties of the concrete are studied. Optimum Content of the admixtures to be used to achieve the specified properties requirements is also studied. Concet construction solution is the leading construction chemical company, which delivers a wide range of products in admixtures, water proofing and roofing solution. In this project various product of the Concet is used. Later to determine biological healing bacterial admixtures prepared using bacillus subtilis was used.

Keywords—accelerators, water reducers, Bacillus subtilis, compressive strength, split tension.

Seismic Analysis of Open Ground Storey Building with Different Plan Configuration and Elevation Symmetry

Gireesha Bhat
Department of Civil Engineering
NMAM Institute of Technology Nitte,
Karkala Taluk, Udupi District, India 574110
gireesha2017@gmail.com

Thushar S Shetty
Department of Civil Engineering
NMAM Institute of Technology Nitte,
Karkala Taluk, Udupi District, India 574110
shettythushar@nitte.edu.in

Abstract— The configuration and symmetry of the building plays a major role under lateral loads in the building. This paper contains the study on seismic behavior of Open Ground Storey (OGS) Building with different combination of plan configuration and elevation symmetry. Further, comparative study on results obtained from Response spectrum analysis are carried out. Modelling is done as per the guideline given in Indian earthquake code IS 1893:2002 and 2016 by using CYPECAD-2018 analysis software. The applicability of code provisions has been checked in this study.

Keywords— Open Ground Storey, Plan configuration, Elevation symmetry, Response spectrum method.

EXPERIMENTAL INVESTIGATION ON THE EFFECT OF POLYURETHANE FOAM ON BLACK COTTON SOIL

Hebbar Adithya[1], Kumara Amith[1], Shetty Akshar[1], Rakshitha[1], Anil Kumar[2]

[1]*U.G student, Department of Civil Engineering,NMAMIT, Nitte, Karnataka, India*

[1]adi.bhebbar@gmail.com

[2]*Asst. Professor, Department of Civil Engineering,NMAMIT, Nitte, Karnataka, India*

[2]kumaranil@nitte.edu.in

Abstract— Throughout the evolution of the human society, the one thing that each person has looked up to is the facilities that are available which includes basic infrastructure, roads etc. When it comes to construction, the durability and quality are important factors. For a stable structure to be constructed the most essential requirement is the presence of a stable base. In the earlier time, when there was no suitable soil beneath the structure, soil replacement used to be carried out. In some places, the method of soil replacement cannot be adopted and hence stabilization of the soil by either physical or chemical methods is carried out. When it comes to soil stabilization the main aim is to stabilize the soil with minimum cost and causing less harm to the environment. The present study focuses on the investigation of effect of polyurethane foam on weak sub-grade soils. Mainly this study involves stabilization of black cotton (BC) soil as it is declared as problematic soil as construction on this soil is very difficult. The study takes place by the addition of liquid polyurethane foam in different percentage by mass of the soil and index and engineering properties along with CBR and Unconfined Compression Strength tests are carried out. The study also furnishes the optimum percentage of polyurethane foam to be added for effective stabilization. It is observed that the strength of black cotton soil can be improved when treated with liquid polyurethane foam. It has been observed that soaked CBR values increased after treatment with liquid polyurethane foam.

Keywords—Black Cotton Soil, Liquid Polyurethane Foam, Stabilization, CBR, Unconfined Compression Strength test

A Parametric Study on SoilStructure Interaction of RC Building with different Base Conditions

Lakshmi L
M.Tech.,(CADS)
Univercity B.D.T College of Engineering
Davangere

Dr.C.M Ravi Kumar
Associate Proffesor, Dept. of Civil Engineering
Univercity B.D.T College of Engineering
Davangere

Abstract—Soil-structure interaction refers to the effects of supporting soil medium on the motion of structure and its subsequent response during earthquakes. Multi-storey buildings could have multiple basements for varied functions viz., automobile parking, boiler system, air-con system, electrical distribution system, and cable tv distribution purpose. This study involves soil structure interaction analysis of a multi-storey building with multiple basements supported on stratified soil medium. The building has 10 floors above the ground and 2 below. Response spectrum analysis has been performed on the structure assuming fixed base, flexible base due to homogenous soil and flexible base due to nonhomogenous or layered soil beneath the foundation using finite element software SAP 2000. Soil properties are included in building model by continuum approach to perform soil structure interaction analysis. Seismic response of multi-storey building viz., lateral displacement, storey drift and modal time period are studied for Indian seismic zone V as per I.S. 18932002. Presence of non-homogeneous soil beneath foundation of multi-storey structures with basements increases the seismic response of the structure significantly compared to homogeneous soil beneath foundation

Keywords—Soil Structure Interaction; Basement Floors; SAP 2000; Non Homogeneous Soil Strata

Strength Characteristics of Concrete Specimens using Arecanut Husk Ash

Kiran Bhat N
PG student in Construction Technology
NMAM Institute of Technology Nitte, Karnataka
kbhatn@gmail.com

Dr. Udayakumar G
Professor and Head, Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka
gudayakumar@nitte.edu.in

Mr. Umashankar Shetty
Assistant Professor in Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka
shettyumashankar@nitte.edu.in

Abstract—Usage of ashes as a partial replacement to the cement in concrete is getting popular in construction industry. Industrial ashes are successfully being used in the field. In the present study, Proportion of 5%, 10%, 15% and 20% by the weight of cement are opted as replacement percentages for AHA. The paper discusses the strength characteristics of concrete due to the partial replacement of cement with Arecanut Husk Ash and finding the optimum percentage of replacement.

Keywords— Arecanut Husk Ash, Strength Characteristics, optimum percentage

A Study on the Effect of Plan Irregularities in the Dynamic Analysis of a Multistorey Structure

Sanjay Naik
Post Graduate student, Department of Civil Engineering
NMAM Institute of Technology, Nitte
Karkala Taluk, Udupi District, India 574110
naiksanjay8808@gmail.com

Thushar S Shetty
Assistant Professor, Department of Civil Engineering
NMAM Institute of Technology, Nitte
Karkala Taluk, Udupi District, India 574110
shettythushar@nitte.edu.in

Abstract—Dynamic analysis is a must for the structures with plan irregularities which are situated in earthquake prone areas. The behavior of regular and irregular shaped structures varies in properties when subjected to seismic force. This study aims at comparing the dynamic response of structures. It involves the modelling of rectangular shape, L shape, C shape and I shape structure with a dimension of 30m x 21m having different area and bay size. The method used for dynamic analysis is response spectrum. The area of the structure may vary but the dimensions remains fixed. ETABS 2016 software was used to model and design the structure. Post analysis of the structure it was found that L shaped structure was found to be weak when compared with other regular and irregular shaped structures.

Keywords—dynamic analysis, plan irregularity, re-entrant corner, response spectrum, mode shapes

HIGH RESOLUTION MAPPING OF SOIL PROPERTIES USING AVIRIS-NG HYPERSPECTRAL REMOTE SENSING DATA - A CASE STUDY OVER LATERITIC SOILS IN MANGALORE, INDIA

Mandar Mohan Chitale
Post Graduate Scholar, Department of Applied Mechanic and Hydraulics
National Institute of Technology Karnataka Mangalore, India
mandarchitale5@gmail.com

SubrahmanyaKundapura
Assistant Professor, Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka Mangalore, India
subrahmanyakundapura@nitk.edu.in

Abstract— Quick and accurate mapping of properties of soil is considered to be critical for agriculture and environment management. Rapid assessment of soil properties is a daunting task in monitoring the environment. The conventional field sampling is a laborious as well as time consuming job. The conventional methods is restricted to a specific region but there is a need to analyses the soil properties at landscape levels. Hence, this study emphasizes on hyperspectral remote sensing which in some extent helps in rapid assessment of the properties. The Hyperspectral data used for the study is AVIRIS-NG data. The study explored the potential of AVIRIS-NG Hyperspectral data in mapping soil properties which were analyzed by in-situ laboratory methods and compared with them by geostatistical method of spatial interpolation. Hence the method adopted for this purpose is the study on spatial variability of soil properties by using Kriging Interpolation technique. Also, a review study is carried out on the Visible and Near Infrared Analysis (VNIRA), Multiple Regression Analysis approach and Spectral Angle Mapper supervised Classification technique on the high resolution AVIRIS-NG Hyperspectral data, which will yield as an empirical model for predicting the soil property in question from both wet chemistry and spectral information of a representative set of samples and classifies the data accordingly. (Abstract)

Keywords— Remote Sensing, Hyperspectral, VNIRA, Spectral Angle Mapper Classification, Kriging

Study on Effects of Hooked End Steel Fiber Reinforced Concrete

Pavan Prasad N. R
M.Tech. in Construction Technology
NMAM Institute of Technology Nitte, Karnataka
pprasad448@gmail.com

Dr. Anil Kumar
Assistant Professor, Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka
kumaranil@nitte.edu.in

Mr. Sujith S.K
Assistant Professor, Department of Civil Engineering
Nagarjuna College of Engineering and Technology Bengaluru, Karnataka
sujithv41@gmail.com

Abstract— With the growing interest in the use of fibrereinforced concrete in the construction industry, attempts have been made to clarify its performance have become important. This study investigates the effect of steel fibre reinforced concrete. Generally steel fiber are used for mitigate the cracks width and enhancing in the concrete member strength. In this, present investigation the study is carried out using steel fiber as reinforcement in concrete (hooked end). In this investigation, properties such as workability of concrete, compressive strength, split tensile strength and flexural strength of the different percentage (0%, 0.5%, 1%, 1.5%, 2%) of steel fiber were carried. From the experimental investigation results it is noted that, by the inclusion of the steel fiber (hooked end) ductility of concrete improved by increasing fiber percentage in concrete. Increase in load absorption capacity, mitigation of cracks in concrete member and enhance in flexural capacity of concrete.

Keywords— Steel Fibre, workability, flexural capacity, ductility, fiber reinforced concrete

A Statistical Approach for Comparison of Secondary Precipitation Products

Rajesh Kommu
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
rajesh.kommu855@gmail.com

SubrahmanyaKundapura
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
subrahmanyakundapura@gmail.com

Venkatesh Kolluru
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
venkateshkolluru95@gmail.com

Abstract— Meteorological data retrieving is the fundamental process for any hydrological research. Precipitation data collection from some constrained territories like high slant geography and inaccessible areas are exceptionally troublesome. Setting the rain gauges is a matter of expense and timely maintenance. To overcome these issues, satellite sensors producing high spatial and temporal resolution datasets can be utilized in the studies involving precipitation component. These satellite products are affected by biases, and hence there is a need for calibration and verification by using ground observation data based on the statistical coefficients. In this study, the most accessible satellite data products, i.e., CHIRPS, PERSIANN-CDR and TRMM are employed to check the accuracies against IMD gridded data for the year's 2000 to 2012 using a statistical approach. Selecting the data product having a high coefficient of correlation and low PBias are utmost necessary. The current study was performed based on Catchment to Catchment (C-C) method by comparing IMD gridded data with satellite datasets obtained from Google Earth Engine. The results can highlight the data product which can conquer the issue of data inaccessibility in the investigation territory and can be utilized as reference precipitation dataset for different hydrological applications.

Keywords—Satellite Products, Precipitation, Statistical Coefficients, Catchment to Catchment

SEISMIC BEHAVIOUR AND COMPARISION OF DIFFFERENT SLAB SYSTEM DIAGRID STRUCTURE

Rahul C
PG Student [1]
Department of civil engineering, NMAMIT, Nitte
Karkala, Udupi district, Karnataka, India.
rahul.18see@gmail.com

Lokesh J.K
Assistant Professor [2]
Department of civil engineering, NMAMIT, Nitte
Karkala, Udupi district, Karnataka, India.
lokeshjk@nitte.edu.in

Abstract— Diagrid system for tall building has evolved as efficient system in terms of lateral stiffness. In this study an attempt has been made to study the seismic response of diagrid structure with different slab system (conventional slab i.e. with beam and flat slab) by using response spectrum analysis. The models studied are square in plan with aspect ratio H/B (where H is the total height and B is the width of structure) as 3.1. Five different diagrid angles 41°, 50°, 56°, 61° and 64°are considered. Earthquake analysis is carried out according to IS 1893:2002(Part-1).Based on the study the efficiency of slab system and optimum diagrid angle is presented in terms of story displacement and storey shear.

Keywords—: Seismic Analysis, diagrid, optimum angle, displacement and shear.

Graphene oxide incorporated concrete for Rigid Pavement application

Akarsh P K
M.Tech in Construction Technology
NMAM Institute of Technology Nitte, Karnataka
akarshpk00784@gmail.com

Arun Kumar Bhat
Professor in Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka
arun.bhat@nitte.edu.in

Abstract— Nanomaterials are currently one of the trending research topics in material science. Due to larger surface area, size, aspect ratios and superior mechanical properties, the nanomaterials can be beneficial in hydration process and nano pore filling activities. Graphene oxide is one such nanomaterial with one its side in nanoscale and other two sides are in larger scale. Because of the presence of oxygen functionalities, the Graphene oxide can be easily dispersed in the aqueous solution when compared to other nanomaterials. Due to increase in traffic condition and environmental impacts, the pavements are not performing up to the design life. The current investigation is about the use of Graphene oxide as cement additive and checking its suitability for the pavement application. In this study, polycarboxylate based superplasticizer is used to improve the adhesion and dispersion property of the Graphene oxide. The graphene oxide is added in the dosages like 0.05%, 0.1%, 0.15% and 0.2% by weight of cement. Number of tests has been conducted to analyze the impact of additive. The workability of Graphene oxide concrete gradually decreases with the increase in its dosage and the loss of workability is not so significant. The mechanical properties of concrete like compressive, flexural and tensile strength are greatly increased with the addition of 0.15% Graphene oxide, which is found out to be optimum dosage. The percentage increase in flexural strength is more than the percentage increase in compressive strength at 7 and 28 days. The percentage improve in early strength is more when compared to later percentage improve. SEM images show, with the presence of Graphene oxide, there is a formation of dense microstructure. The overall test result shows that Graphene oxide can be used in pavement quality concrete.

Keywords— Nanomaterials, Graphene, Graphene oxide, Oxygen functionalities, Dispersion properties, Pavements

Identification of Best-Fit Probability Distribution and Modelling Short Duration Intensity Duration Frequency Curves – Mangalore City

Femin C Varghese
Dept. of Applied Mechanics and Hydraulics
National Institute of Technology, Karnataka Mangalore, India
fvarghese421@gmail.com

Dr. K Varija
Dept. of Applied Mechanics and Hydraulics
National Institute of Technology, Karnataka Mangalore, India
varija.nitk@gmail.com

Abstract: Frequency analysis is performed in this study, to identify the most suitable model which could predict extreme events like rainfall and flood. It aims in defining the most suitable probability distribution model for annual maxima series of chosen four stations in Mangalore City. Statistical analysis such as Generalized Extreme Value (GEV), Log-Normal, and Log- Pearson, was applied, and parameters of these distributions were assessed. The predicted values using these distributions subjected to the goodness of fit test using the Kolmogorov-Smirnov test, Anderson-Darling test, and Chi-squared test. Generalized Extreme Value distribution gave the best-fit model and thus, used for deriving the Intensity Duration Frequency (IDF) curves for Mangalore City. IDF curves using empirical equation and GEV distribution were compared, and GEV distribution IDF curves give higher rainfall intensities.

Keywords: Probability distribution: Goodness of fit; Generalized Extreme Value (GEV); Intensity Duration Frequency (IDF) curves

Prediction of Effect of Geometrical Parameters in Trough Shape Folded Plate Roof Using ANN Modelling

1st Bhagwan Girish Shanbhag
P.G. Student, Department of Civil Engineering,
NMAM Institute of Technology, Nitte, Udupi, Karnataka, India
bhagwan.shanbhag13@gmail.com

2nd Y R Suresh
Associate Professor, Department of Civil Engineering,
NMAM Institute of Technology, Nitte, Udupi, Karnataka, India
sureshyr@nitte.edu.in

Abstract- Finite element method is a numerical technique used to obtain approximate solutions to the problems with boundary values. It is simply a technique used in solving problems which has partial differential equations and boundary conditions. This method gives approximate results at each and every discrete number of points over the domain. A consistent model is to be developed for easier, faster and less expensive structural development. In this regard, Artificial Neural Network can have high possibilities as these networks are universal approximators that can carry out any uninterrupted mapping and can provide general mechanisms for building models from data whose input-output relationship is highly nonlinear. In this paper, the behavior of trough shape folded plate roof is studied in terms of displacement and stresses for different boundary conditions using the software SAP-2000 (v-20) by varying geometrical parameters (thickness, bay width and height of FPR) and to extract the information on the importance of the input parameter on the prediction of output results using Artificial Neural Network model.

Keywords—Artificial Neural Network, Finite Element Analysis, Folded Plate Roof, Garson Algorithm

Prediction of Influence of Geometrical Parameters in an Elliptical Paraboloid Shell Roof Using ANN

Anusha B Rao
Department of Civil Engineering,
NMAM Institute of Technology, Nitte, Udupi, India
anusharao94@gmail.com

Y R Suresh
Department of Civil Engineering,
NMAM Institute of Technology, Nitte, Udupi, India
sureshyr@nitte.edu.in

Abstract—In the analysis of various engineering problems, Finite Element Method (FEM) is considered as one of the significant tools and has been broadly used in many fields. Employing this method aids in simulating the deformable complex objects comprising material and structural properties and determines the model's response to definite loading conditions. For an easier, quicker and less expensive analysis of structures, a consistent model has to be developed. However, many techniques optimize the system performance; the intelligent method design is a valuable technique in optimizing the efficiency of such systems. One of the emerging intelligence techniques is Artificial Neural Network (ANN) which is used in modelling, simulation and system organization. To solve complex and nonlinear problems ANN tool is faster and more precise as compared to other conventional techniques. The present work is carried out to predict the behaviour of Elliptical Paraboloid Shell (EPS) roof based on the output obtained from an ANN model. The results show that the ANN technique works faster and predicts the output with less error and is an appropriate method to model the performance of shell roof structure. The influence of the geometrical parameters of the shell in the prediction of deflection has been studied.

Keywords— Artificial Neural Network Modelling, Finite Element Method, Shell Roof, Simulation, Garson's Algorithm.

Effectiveness of SHE Program Implementation at Construction Site

Caliba Mariola Vaz[1], Sayed Mohammed Maaz[1], Teena Twinkle Monteiro[1], Prahlad G. B[1], Dr. B Radheshyam[2], Dr B Yajnheswaran[3]
[1] *UG Students,* [2] *Professor,* [3] *Associate Professor*
St Joseph Engineering College, Vamanjoor
Corresponding Email: vazcaliba19@gmail.com

Abstract- Safety is one of the most important aspect in a human's life. It helps us to stay away from various hazards and injuring one's self. The need for safety at a construction site is very high. Most number of deaths recorded each year are due to unsafe acts. It is not only safety against one's life but also safe acts towards the heath of the labour and the surrounding environment. There are various organisations that provide laws and guidelines which the companies can follow in regard to SHE (Safety Health and Environment). Everything around us is a potential risk to our lives. Risk assessment is an important factor which helps in reducing the various accidents, fatalities, illnesses. This helps in enhancing the well-being of employees. The main cause of accidents is credited to failure of workers to obey instructions, carelessness of workers and not using the required PPE's. The objectives in this paper assess effectiveness of the SHE programs implemented at construction sites. The Occupational Safety and Health Act was passed in 1970 to protect employees by stating that employers have a legal obligation to provide their employees with a safe working environment and safety protection in construction area [1].

Keywords- Safety, Health, Environment, Hazards, Accidents, Labour, Construction

Analysis of RC Irregular Building According to Different Seismic Design Codes

BaburaoAnuse
Research scholar,
Department of civil engineering, Ashta, India
baburaoanuse1996@gmail.com

Prof. Kiran Shinde
Department of civil engineering,
Annasahebdange college of engineering &tecvhnology,
Ashta, India
kks_civil@adcet.in

Abstract. This paper addresses the analysis of irregular multistoried RC frame building according to different seismic design codes. A RC multi-story building are subjected to most dangerous earthquake, the main reason for failure of RC buildings is irregularity in its plan dimensions. This paper presents analysis of irregular building using different seismic design codes. Building is compared in terms of structural displacement, drifts and story shear. And also focuses on three seismic design codes India (IS 1893), U.S. (ASCE 7) and Europe (EC8). Irregular L-shape 10-story buildings are analyzed using the Equivalent Static Load method (ESL).

Keywords—Seismic analysis, building codes, irregular plan, Equivalent static analysis, ETABS

Development of Mobile Application for Computing SBC of Soil and Design of Shallow Foundation

Shivaleela[1], Amina Maureen[1], Abdulla Sahl[1], Anees Anwar[1], Anil Kumar[2]
[1]*B.Tech student, Department of Civil Engineering, NMAMIT, Nitte, Karnataka, India.*[1]aminamaureen07@gmail.com
[2]*Asst. Professor , Department of Civil Engineering, NMAMIT , Nitte , Karnataka , India*[2]kumaranil@nitte.edu.in

Abstract— This paper focuses on the development of an android based mobile-application by the name 'Ground IQ' for foundation works in the field of civil engineering. The first stage involves manual calculation of Safe Bearing Capacity of Soil based on codal provisions of IS-2720 and equations developed by Terzaghi (1943). Here, Safe Bearing Capacity is computed by IS Code Method (1981) which is again developed from Terzaghi's method. Its value is compared with that which is obtained as a result from the application developed. In the second stage, the computed SBC is used to design footing or foundation on the site from where the soil sample is collected. The design can be then compared with that obtained from the application developed and checked for accuracy. The IDE (Integrated Development Environment) or the platform used for the development of this application is Android Studio which supports Java programming language for coding.

Keywords— SBC, footing, reinforcement details, Java, Android Studio, XML.

IMPACT OF WATERSHED DEVELOPMENT PROGRAMME ON GROUNDWATER RECHARGE A CASE STUDY OF ITAGI WATERSHED KARATAKA, INDIA

Palakshappa K
Professor, Civil Engineering Dept.,
P. A College of Engineering Mangalore-574 163, Karnataka, India
palakshappa@yahoo.com

Umapathi Assistant
Professor, Civil Engineering Dept.,
J. N. N College of Engineering Shimoga-577 004, Karnataka, India
umapathi75@gmail.com

Sneha M K Assistant
Professor, Civil Engineering Dept .,
Achraya Institute of Technology Bangaluru-560107, Karnataka, India
snehamatad@gmail.com

Abstract- Watershed Development Programs (WDP) started in India basically as soil and water conservation programs, as a policy response to the increasing environmental crisis and nonsustainability of agriculture especially in the dry land / semiarid regions. One of the main objectives of WDP is to augment the groundwater recharge. It is acknowledged from many of the studies that impact of soil and water conservation interventions on groundwater recharge was quite perceptible in almost all watersheds. In the present study area of Itagi watershed the various soil and water conservation structures such as contour bunds, check dams, farm ponds, recharge pits, earthen checks, rubble checks etc., were constructed in an area of 4636 hectares (ha) under Sujala watershed development programme, during the year 2004. The total implementation cost of these structures is Rs. 35.66 million which includes administrative cost to the tune of Rs. 1.981 million. It is observed that the annual natural groundwater recharge in the study area is about 9.6% of annual rainfall. After implementation of watershed development programme it is found that the groundwater recharge is about 21.38%. Also it is noticed that after the watershed development programme the yields of the wells were improved and brought more area under irrigation and crop diversification.

Keywords: watershed, groundwater, conservation, recharge, yield of the wells

Monitoring Land Use and Land Cover Changes in Coastal Karnataka

Satish Kumar Mundlamuri
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
satishmundlamuri@gmail.com

Venkatesh Kolluru
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
venkateshkolluru95@gmail.com

S B Gowthami
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
siranagowthami@gmail.com

Anjita N.A
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
anjitaneelatt@gmail.com

Nayana N
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
nayananarayanan627@gmail.com

Linda Regi
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
linda.regi.1994@gmail.com

G.S Dwarakish
Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
dwaraki.gs@gmail.com

Abstract— The dynamics of land use/ land cover can be studied by using digital change detection techniques which are highly significant for the evaluation and development of management strategies in a region. The environmental and hydrological processes prevailing in the area can be interpreted only by analyzing the alterations in past and present land use land cover classes. In view of this, the present study is executed to analyze the typical land use change in the coastal region over the three decades by analyzing historical and current LU/LC (Land Use Land Cover) datasets. Landsat 5 and Landsat 8 satellite datasets were considered for change detection analysis using unsupervised classification method. K-means algorithm, a widely used unsupervised classification technique was adopted in this study to classify coastal region of Karnataka for the years 1990 and 2019. The level-ii classification was performed on LU/LC raster datasets (Landsat 5 and 8) which segregated the entire study area into ten classes namely agricultural land, barren land, built-up area, water, forest, fallow or cultivated land, scrub forest, sandy area, swampy forest and wetlands. This study encapsulated that, about 40% of the study area was occupied by water body followed by forestry with a percentage of around 30%. Major changes were observed in the barren land and scrub forest between 1990 and 2019, where the barren land was replaced by scrub forest in 2019. The accuracy assessment is performed to analyze the efficiency of the algorithm and the precision of the classified image which showed an accuracy of 81% in 1990 and 84% in 2019 demonstrating the ability of an algorithm to classify reliably.

Keywords— LU/LC Classification, Change Detection, K-Means Algorithm,

PERFORMANCE OF ALKALI ACTIVATED MORTAR MIXES CONTAINING INDUSTRIAL WASTE MATERIALS AS BINDERS

Dr. Vaibhav Chate
Dept of civil engineering
KLS Gogte Institute of Technology, Belagavi, India
email: vrchate@git.edu

*Dr.NitendraPalankar
Dept of civil engineering
KLS Gogte Institute of Technology, Belagavi, India
email: nnpalankar@git.edu
*Corresponding Author

Dr. Mithun B.M
Dept of civil engineering
NMAM Institute of Technology, Karkala, Udupi, India
email: mithunbm@nitte.edu.in

Abstract—The current study is aimed at to determine the optimum mix parameters for developing the mortar blocks using Red Mud (RM), Cement Kiln Dust (CKD) and Silica Fume as binder. In the present study, an attempt is made to prepare alkali activated mixes containing Red Mud (RM), Cement Kiln Dust (CKD) and Silica Fume as binder. Various strength properties of mortar blocks at different time intervals (days) were investigated. From the results, it was found that the compressive strength of red mud blocks improved with the addition of higher contents cement kiln dust and silica fume. The mixes with red mud as sole binder and with lower contents of CKD and silica fume displayed higher water absorption and total porosity. The UPV values mixes showed better performance with increasing contents of silica fume and CKD. The resistance to abrasion was found to be better for mixes which contained higher proportions of CKD and silica fume respectively. All the mixes displayed sufficient strength and durability performance to suit the requirement of bricks based on the type or class of bricks.

Keywords—Eco-friendly Mortar, Industrial waste, Mechanical properties, durability.

Design and Fabrication of Low Cost Water Purification unit

Prashant Kurdekar
Assistant Professor
Department of Civil Engineering
St. Joseph Engineering CollegeVamanjoor, Managaluru, India
prashantk@sjec.ac.in

Karuna
Department of Civil Engineering
St. Joseph Engineering College Vamanjoor, Managaluru, India
knaik432@gmail.com

Mamatha
Department of Civil Engineering
St. Joseph Engineering CollegeVamanjoor, Managaluru, India
mamathasuvcvl@gmail.com

Muthuraj
Assistant Professor
Department of Civil Engineering
St. Joseph Engineering College Vamanjoor, Managaluru, India
muthuraj280197@gmail.com

Shashank D
Department of Civil Engineering
St. Joseph Engineering CollegeVamanjoor, Managaluru, India
shashank.hunter.12@gmail.com

Abstract— As day by day the development takes place the effect on environment is also increasing, due to this the natural resources such as water which is essential for human survival is getting polluted. To provide a safe portable drinking water to people it is necessary to use water purifiers, especially for rural population. Therefore, in this research the ability of silica, activated carbon was investigated in removal of turbidity, total hardness, total dissolved solids, chloride and electrical conductivity. As a result, activated carbon can remove turbidity, electrical conductivity and total dissolved solids very efficient, while silica is more appropriate in removal of chloride, total hardness. According to the results, if we use these adsorbents separately it will be insufficient for the removal of parameters. To increase the efficiency for filter unit it is proposed that combination of these cartridges should be used.

Keywords—Water, Activated Carbon, Silica

Water Level Retrieval and Water Body Mapping: A Case Study of Nagarjuna Sagar Reservoir

NalluriAhalya
Post Graduate Scholar
Dept. of Applied Mechanucs and Hydraulics
National Institute of Technology Karnataka Surathkal Karnataka, India
nalluriahalya@gmail.com

Dr. H. Ramesh
Associate Professor
Dept. of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka Suratkal Karnataka, India
ramesh.hgowda@gmail.com

Abstract— Satellite radar altimetry is exclusively designed for the oceanographic studies such as wind speed, sea surface level, tide height, and volumetric changes. In spite of the fact that the satellite radar altimetry is predominantly intended for oceanographic studies and ice sheet monitoring these days, the utilization of altimetry information is reached out to think about water dimension of inland water bodies like reservoirs, rivers and so on. This study covers the use of SRAL (SENTINEL-3 Ku/C Radar Altimeter) for the monitoring water level of Nagarjuna Sagar reservoir located in Telangana state, India. Satellite altimetry works on the principle of Range Measurement that is the measure of the travel time of microwave pulse from emission to receiving which is interrupted by many atmospheric conditions which cause a disturbance in travel time of microwave pulse which is to be adjusted to get corrected depth of water level. The SRAL information is handled utilizing BRAT (Broadview Radar Altimetry Toolbox) programming. The consistency of derived water level is compared using field data, all the depths are with in error range of one meter. Water body mapping is carried out utilizing cloud-free data of Landsat-8 from January 2016 to March 2019 which showed a gradual decrease in water level from November to May.

Keywords—- SRAL, Inland water body, Water level, Water spread area

Delay in Construction Due to Logistic Factors– A Case Study on Mumbai High Rise Buildings

Anubhav Kaushik
Dept. of Civil Engg.
National Institute of Technology Surathkal, Mangalore, India

C. Rajasekaran
Dept. of Civil Engg.
National Institute of Technology Surathkal, Mangalore, India

Raut Shekhar Madhukar
Building & Factories IC
L&T Construction
MBCL, India.

Abstract—Construction logistics is a multi-disciplinary approach which strives to guarantee at the right time, cost and quality activities such as material supply and handling, schedule control, site infrastructure and equipment location, site physical flow management, traffic arrangements on and around the construction site and information related to all physical and services flow. The main task of an integrated logistics system is to provide just in time deliveries when needed to eliminate most of the materials handling and storage on site, to shorten time of project completion by eliminating reasons of work stoppage and to minimize the local negative external effects. This Research work aims to identify the factors that affect the efficiency of logistics of a site and causes delay to the project. Then these factors will be ranked based on likelihood of their occurrence and degree of their severity using statistical techniques. Then effects of such critical factors on project will also to be discussed.

Keywords —Logistics, critical factors, delay, rank, occurrence, severity, rank, effects, statistical techniques.

Removal of 2,4-D Herbicide from Water by Electro-coagulation using Copper electrodes

Sarika K[1], Sneha K[2], Shivani M[3], Shefali B[4], Sangami S[5]
[1234]*UG students, Department of Civil Engineering, Jain college of Engineering, Belagavi.*
[5]*Associate Professor, Department of Civil Engineering, Jain College of Engineering,Belagavi.*
Corresponding author. Tel: +91 8088168977(Sarika K), +91 9945754311(Sanjeev Sangami)
Email address: sarikakeserekar97@gmail.com,sanjeevenv08@gmail.com

Abstract— Herbicide poses a serious threat to living organisms owing to their non-biodegradability and toxicity. Among all, 2,4-D is one of the EDC (Endocrine disrupting compounds), which is used to kill the weeds in the crop field. During heavy rainfall, the residual 2,4-D join the surface water body and thereby increasing the toxicity level. Hence in this study, electro coagulation (EC) using copper electrodes was applied to remove the 2,4-D in water. The electro coagulation has several advantages, which include ease of operation and the scope for automation. Here, the effect of three factors, viz. pH, time, and 2,4-D concentration on the removal percentage were studied. In pH 5,7 and 9 with 2 electrodes configuration, the 2,4-D concentration removal was 35, 47 and 82% respectively. Whereas for 4 electrodes, the removal efficiency was 52, 82 and 99% respectively. The maximum 2, 4-D the removal was observed with pH of 9 in 50 minutes. Higher the initial concentration, lesser the removal efficiency was observed.

Keywords- Electro coagulation, Agriculture runoff, Herbicides, 2,4-D.

ESTIMATION OF RUNOFF USING RS AND GIS FOR VRISHABHAVATHI WATERSHED BY SCS-CN METHOD

Rajitha E
Post Graduate Scholar
Department of Civil Engineering,
University of Visvesvaraya College of Engineering
Bangalore University, Jnanabharathi
Bengaluru – 560056 Karnataka, India.
(Email-ejinkalarajath@gmail.com)

A S Ravikumar
Professor Department of Civil Engineering
University of Visvesvaraya College of Engineering
Bangalore University, Jnanabharathi,
Bengaluru - 560056 Karnataka, India.
(Email-profasrk68@gmail.com)

Abstract- Runoff is one of the most important hydrologic variables used in most of the water resources applications. Prediction of quantity and rate of runoff from land surface into streams and rivers is difficult and time consuming to obtain for an ungauged watersheds. However, this information is needed in dealing with watershed development and management. In the present study, an attempt has been made to estimate runoff using Remote Sensing (RS) and Geographic Information System (GIS) techniques. The study area chosen is Vrishabhavathi watershed which is a tributary to river Arkavathi. The watershed is having an area of 378.15 km2 and is covered on Survey of India (SOI) toposheet numbers 57G/12, 57H/5, 57H/6 57H/9. The watershed is delineated using SOI topomaps and Shuttle Radar Topography Mission (SRTM) DEM data. Different thematic maps such as Land use/land cover (LULC), soil. etc., are obtained from Karnataka State Remote Sensing and Application Centre (KSRSAC), Bengaluru. The USDA SCS curve number method has been used to estimate the daily runoff. Runoff for the Vrishabhavathi watershed is estimated from daily rainfall of 19 years (1998 to 2016). The rainfall data collected from Department of Statistics and Economics, Bengaluru reveals that the watershed has received the maximum rainfall of 1209.66 mm recorded in 2015 and minimum rainfall of 460.06mm in 2012. The correlation coefficient has shown positive correlation between the rainfall and the runoff.

Keywords- Remote sensing, GIS, Runoff estimation, SCSCN method.

Stabilization of Contaminated Soil by Geo-polymers and Bio-enzymes: A review

Swathivarma R
M.tech student
Dept. of Civil Engineering NMAMIT, Nitte

Dr. Anil Kumar
Assistant Professor
Dept. of Civil Engineering NMAMIT, Nitte

Megha Mayuri B G
M.tech student
Dept. of Civil Engineering NMAMIT, Nitte

Abstract—As a growing third world country, India is developing in terms of its infrastructure. It is a well-known fact that infrastructure of any country symbolizes its economic growth. There is a growing need of finding the alternative materials for the construction activities along with utilizing the already existing materials by modifying its property to suit the requirements. This paper reviews such an engineering approach towards changing the properties of contaminated soil and stabilizing it by using geopolymers as well as naturally found soil enzymes.

Keywords:- Geo-polymers, Enzymes, Contaminated soil.

Effect of Landfill Leachate on Performance of Subgrade Soil

Manjunath G[1], Aishwarya A[2], Mallikarjun I[3], Radha P[4], Sangami S[5]
[1,2,3,4] *UG students, Department of Civil Engineering, Jain college of Engineering, Belagavi.*
[5]*Associate professor, Department of Civil Engineering, Jain college of Engineering, Belagavi.*
Corresponding author. Tel:+91 9535696545 (Manjunath G), +91 9945754311 (Sangami S).
E-mail addresses: manjunath.gurugunta24@gmail.com,sanjeevenv08@gmail.com.

Abstract— Leachate is a hazardous liquid which percolates through the landfills and extracts dissolved and suspended hazardous matter from it. Large quantities of municipal solid waste which consist of chemical, industrial and biomedical wastes are received by dump yards, which creates environmental problems such as pollution of soil and groundwater. In the present study, the laboratory test was conducted on both contaminated and uncontaminated (collected soil sample from college campus) lateritic soil to determine the effect of landfill leachate on the performance of subgrade soil. The contaminated soil samples were prepared by mixing the soils with MSW leachate in the increments of 0%, 5%, 10% and 20% by weight. Finally, all subgrade soil properties were analyzed. For contaminated soil, Atterberg's limits increase with the increase in the leachate content. The MDD is maximum till 10%, and after that, it is decreased. The results showed that the MSW leachate affects the compaction characteristics, shear strength and atterberg's limits of the lateritic soil.

Keywords- Leachate, Lateritic soil, Compaction characteristics, Atterberg's limits, CBR

STUDY OF BEHAVIOUR OF HIGH RISE BUILDINGS WITH DIAGRID SYSTEMS

Mangesh Vhanmane
Research scholar, Department of civil engineering,
Annasahebdange college of engineering and technology, Ashta, India 416301
mangeshvhanmane92@gmail.com

MaheshkumarBhanuse
Assistant professor, Department of civil engineering,
Annasahebdange college of engineering & technology, Ashta, India 416301
maheshbhanuse07@gmail.com

Abstract— High rise structures are growing speedily around the world. The unique geometric arrangement of the system provides the efficiency of structure and beauty capabilities, the new structural system with diagrid has been used extensively for the recent high buildings. The diagrid is an arrangement of triangulated beams; it has a straight or curved and horizontal ring system which makes the combined structural system for skyscrapers. Diagrid structure uses fewer materials than traditional structural systems with orthogonal members. The efficiency of diagrid system reduces number of inner columns so that the design of the plan gets more flexibility. This research study aims to explore the applicability of diagrid systems in high rise buildings, over conventional construction systems. A square plan 32m × 32m dimensions is taken to study of behaviour of high rise building with a diagrid system. All structural members like beams, columns, etc. are analyzed considering all load combinations as per IS 800:2007. Similarly, analysis of G+40, G+60 and G+80 storied structures with diagrid system is taken to comparison of the results for parameters like storey shear, storey drift and storey displacement are also represented in paper. For modeling and analysis purpose, ETABs software is used.

Keywords— High rise buildings, Diagrid systems, Gravity & lateral load resistance, ETABs 2017.

Measurement and Analysis of Noise Levels in the Sensitive Areas of Mysuru City, India

H.G Vivek Prasad
Department of Construction Technology and Management
Sri Jayachamarajendra College of Engineering Mysuru, India
vivekprasad22@gmail.com

Sanjana Suresh
Department of Construction Technology and Management
Sri Jayachamarajendra College of Engineering Mysuru, India
sanjsuresh209@gmail.com

Dr.B.Manoj Kumar
Department of Environmental Engineering
Sri Jayachamarajendra College of Engineering Mysuru, India
manoj_kumar_b@hotmail.com

Sachith Kothari
Department of Construction Technology and Management
Sri Jayachamarajendra College of Engineering Mysuru, India
sachithkothari97@gmail.com

Abstract—Due to the particular characteristics of hospitals, the hospital buildings are highly sensitive to environmental noise. However, they are usually located close or within urban agglomerations and in particular main roads. Hence, hospitals are, in many cases, exposed to high levels of environmental noise. In this study of comprehensive one-month research project, traffic and community noise levels were measured and monitored at five sensitive areas (near hospitals) in its spatialtemporal aspect, at the city of Mysuru, Karnataka. Noise measurements were taken at different peak sessions in morning and evening, for duration of one hour. Observed noise values were analyzed and compared with the recommended permissible limits (40-50 dB) as stated by the Central Pollution Control Board (CPCB). The measured values exceeded the CPCB noise limits prescribed for sensitive areas. This paper presents an analogy of obtained noise readings with the national CPCB standards for silent zones.

Keywords— Noise Levels, Dosimeter, Sensitive Areas, CPCB

Impact of Rainfall on Land Use And Land Cover Analysis

Suma B N
Civil Engineering Department
Global Academy of Technology Bengaluru, India
suma.raghavendra79@gmail.com

Srinivasa C V
Civil Engineering Department
Global Academy of Technology Bengaluru, India
svasa@gat.ac.in

Abstract—In the present paper the study emphasizes on providing suitable water conservation measures to study area as it is a drought prone area. The rainfall is uneven and nonuniform it poses a severe water scarcity problem in the region as agriculture is the main occupation of the people. Hence a proper water conservation practice would solve the water problem. Thus, the paper presents the importance of land use and landcover changes analysis prior to locating the water conservation structures. The NDVI method and unsupervised classification technique using Landsat images of different years of the same date is used for the study. The analysis is carried out taking Thiessen average rainfall from the different raingauage stations were studied. Thus, in the paper feasibility assessment for the catchment area has been conducted using the change detection analysis before planning and development of the watershed.

Keywords—watershed planning, NDVI, land use and cover change, rainfall, satellite images

Constructive Scope on Implementation of Copper Slag as Replacement for Natural Fine Aggregate- An Overview

Thilak Kumar Y T
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
thilak8741@gmail.com

Arpitha D
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
arpitha.5790@gmail.com

Sudarshan V J
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
joresudarshan@gmail.com

C. Rajasekaran
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
bcrajasekaran@nitk.edu.in

Nagesh Puttaswamy
Ultratech Cement Ltd Bengaluru, Karnataka
nagesh@nageshp.com

Abstract— This paper communicates organised work on copper slag drawn from scientific literature which comprises of evaluation of physical and chemical characteristics, mechanical and durability properties in the marine environment. Analysis of test data derived from previously available sources reveals that copper slag having similar basic characteristics is an acceptable alternative material to river sand to produce concrete of all grades. The lesser water absorption property of copper slag is very significant peculiarity which attributes to develop high strength in concrete. The behavior of concrete produced using copper slag to the concrete made corresponding to sand component shows identical behavior in the fresh and hardened state. As an aggregate copper slag has an ability to be replaced with fine aggregate thereby the advance progress in the concrete technology will revolutionise the mixture of different conventional ingredients to uplift the epected properties of concrete to renew its definition. Hence alternative materials to be used as fine aggregate will reduce the burden on the environment which is being extensively investigated all over the world looking to the significant requirements, quality, and properties which has been a global consensus on the materials.

Keywords— Concrete, Copper slag, Replacement with sand, Review, Waste, Mechanical properties

Assessment on performance of Steel slag and Processed Granulated Blast furnace Slag as an alternative for fine aggregate-An assertive review

Sudarshan V J
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
joresudarshan@gmail.com

Arpitha D
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
arpitha.5790@gmail.com

Thilak Kumar Y T
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
tilak8741@gmail.com

C. Rajasekaran
Department of civil engineering
National Institute of Technology Karnataka
Surathkal, Karnataka
bcrajaekaran@nitk.edu.in

Nagesh Puttaswamy
Ultratech Cement Ltd Bengaluru, Karnataka
nagesh@nageshp.com

Abstract— Sand has always been an integral part of construction in our civilization. It has been the most easily available and acceptable source for the same. However, the depletion of river sand availability has started looking at the alternatives including some industrial by-products. One of them is slag obtained from manufacture/refining of metals which would help in the utilization of industrial waste and conservation of natural resources to have a sustainable construction. This paper provides the gist of organized overview involving the evaluation of physical and chemical characteristics, assessment of mechanical and durability properties for the effective utilization of steel slag and processed granulated blast furnace slag (PGBS) that could be modeled from previous researches related to the study. The basic properties of steel slag and PGBS exhibit requisite properties like river sand which is an indication for a possible alternative material to the conventional aggregate. The multiple processing of slag has its influence on strength, durability, and workability of concrete. These recent innovations have made the slag economically viable and environmentally friendly, also profitable salvaging of processed by-product.

Keywords— sustainable construction, steel slag, PGBS

An experimental study on self remediating bacterial concrete

S.Girish
Professor
Department of Civil Engineering
BMS College of Engineering Bangalore, Karnataka, India
(Correponding author) girish.civ@bmsce.ac.in

T. Soumya
Assistant Professor
Department of Civil Engineering
BMS College of Engineering Bangalore, Karnataka, India
soumya.civ@bmsce.ac.in

Sahana Girish
Post Graduate Medical Student,
Rajarajeswari Medical College and Hospital Bangalore, Karnataka, India
drsahana1992@gmail.com

Abstract - The bacterial concrete is a self remediation biomaterial under favorable conditions. Bacteria can precipitate calcite in concrete or form a layer of calcite precipitation plays an important role in remediation of the plastic shrinkage micro cracks thereby increasing the long term structural integrity and durability of concrete. This study investigates the impact on compressive strength of concrete by addition of aerobic microorganism such as bacillus subtilis and bacillus Megaterium, which microbiologically induce the mineral precipitation. The bacteria were incorporated into the 100mm concrete cube in different concentrations in two stages formerly by curing in distilled water and later by curing in peptone based nutrient medium. The results show the positive impact on compressive strength of concrete cubes with an increase in the strength of 30% with bacillus megaterium. The strength enhancement is due to the precipitation of calcite within the pores which in turn improves the pore structure of the concrete. The study also revealed the importance of culture media, type of micro organism and cell concentration on the strength properties of bio concrete. However there was no much improvement in strength by curing in nutrient medium.

Keywords- Bacterial Concrete, Remediation, Self Healing

An Experimental Investigation on suitability of ground water for construction practice

Ms Pooja D
Mtech student
Department of Civil Engineering
NMAM Institute of Technology, Nitte
poojadeepak2728@gmail.com

Mr Pushparaj A.Naik
Assistant Professor
Department of Civil Engineering,
NMAM Institute of Technology, Nitte
pushparajmani@nitte.edu.in

Dr Udayakumar G.
Professor Department of Civil Engineering,
NMAM Institute of Technology, Nitte
hodcv@nitte.edu.in

Ms Pooja K
Assistant Professor
Department of Civil Engineering,
Sahyadri college of Engineering & Management, adyar
poojak.civil@sahyadri.edu.in

Abstract— This study provides the suitability of groundwater of a village named Boloor of Dakshina Kannada District, Mangalore for construction practice in the mansoon season and dry season. So, M20 grade concrete cubes with water cement ratio of 0.45 is been casted from the 15 groundwater samples of different region of the locality to find compressive strength at 7 and 28 days for both wet season and dry season. For calculating the water quality of 15 groundwater samples various parameters like pH, alkalinity, chloride, iron, hardness etc are compared with Indian Standard Drinking water specification IS: 10500-2012. It involves comparison of strength characteristics of groundwater and potable water.

Keywords— Water Analysis, Permissible limit, ground water, compressive strength.

Rainfall Trend Analysis in Coastal Region of Karnataka

Ashwin S
Dept of Civil Engineering.
NMAM Institute of Technology Nitte, India
s.aswi4u@gmail.com

Prashanth Kumar K
Dept of Civil Engineering
NMAM Institute of Technology Nitte, India
prashdev1987@gmail.com

Vinay D C
Dept of Applied Mechanics
National Institute of Technology Surathkal, India
vinaydc@gmail.com

Abstract— Climate can be defined as the weather conditions or the weather patterns that is present in the particular geographical area for a very lengthy period. It can be assessed by the important factors like temperature, humidity, wind, precipitation. The climate of the region also depends on the latitude, terrain, water bodies etc. Coastal Karnataka receives an average rainfall, of 3456mm, at summer the temperature lies between 33.5- 40 degree Celsius and the minimum temperature of 23.3- 27.9 degree Celsius. Tropical monsoon climate covers whole coastal places of Karnataka and other nearby places too. Rainfall time series is divided into four periods. This region has a very hot climate with extreme rainfall in monsoon season i.e., June to September. These drastic changes in the climate severely affects the various activities throughout the coastal area of Karnataka. Understanding the variability of climate in the region is essential. In this study the variation in the climate for a period of 1984-2017 is observed and investigated and changes in the trend in the grid points can be noticed. Mann Kendall trend test is applied for the precipitation to find trend patterns and the magnitude of the trend is determined by the Sen's slope estimator. Increase in trend was found in the Grid point 3 and Grid point 4.

Keywords— Rainfall, Trend Analysis, Mann Kendall, Coastal area.

Sorptivity as a Durability Index for Service Life Prediction of Self-Compacting Concrete

Girish S
Professor
B M S College of Engineering,
Bangalore, India.
e-mail:
girish.civ@bmsce.ac.in(corresponding author)
ORCID : 0000-0002-6996-3222

Ajay N
Research Scholar
B M S College of Engineering,
Bangalore, India.
e-mail:
ajayeng2000@gmail.com
ORCID : 0000-0001-8336-5029

Sowamya T
Assistant Professor
B M S College of Engineering,
Bangalore, India.
e-mail:
soumya.civ@bmsce.ac.in
ORCID: 0000-0001-7851-5221

Abstract—Durability of concrete is assessed by its Permeation to know long term performance and sustainability. Water ingress is the major factor for deterioration of concrete and there is always an urge to find a simple and reliable way to measure the material properties of concrete which can be related to durability. Water sorptivity is a useful single material property which can be one of the measures of durability useful in service life planning and prediction, especially in severe environmental conditions.

This paper presents the results of the comparative study of sorptivity of Self-Compacting Concrete (SCC) with conventionally vibrated concrete (CVC). SCC has its own unique advantage over CVC due to its characteristics of higher powder per se paste with higher flow and better lubrication of the aggregate with reduced inter particle friction and superior densification of microstructure. SCC mixes were developed for the paste contents of 0.38, 0.41 and 0.43 with fly ash as the filler for different cement contents ranging from 300 to 450 kg/m3. The study shows better performance by SCC in terms of capillary absorption. The sorptivity value decreased as the volume of paste increased.The use of higher paste content in SCC can make the concrete robust with better densification of the microstructure, improving the durability and making the concrete more sustainable with improved long term performance. The sorptivity based on secondary absorption can be effectively used as a durability index to predict the time duration required for the ingress of water to penetrate the concrete, which has practical significance.

Keywords : Self-Compacting Concrete, Sorptivity, Volume of paste, Service life.

A STUDY ON SHORE LINE DYNAMICS DURING AND POST-CONSTRUCTION OF BREAK WATERS IN KASARAGOD FISHING HARBOUR

VADELU KRISHNA CHAITANYA
Department of Applied Mechanics and Hydraulics
N.I.T.K, Surathkal Mangalore INDIA- 575 025
Krishnac252@gmail.com

T. NASAR,
Assistant Professor
Department of Applied Mechanics and Hydraulics
N.I.T.K, Surathkal Mangalore INDIA- 575 025
t.nasar@gmail.com

KUNHIMAMMU PARAVATH
Department of Applied Mechanics and Hydraulics
N.I.T.K,Surathkal Mangalore INDIA- 575 025
kunhimammup@gmail.com

Abstract— Coast belonging to one particular stretch happens to be versatile because of its dynamicity. This dynamicity is accounted because of both natural and manmade activities. Hence, it is necessary to monitor any fragile coastal stretch's dynamicity in a temporal basis. In this study, an attempt is made to study the dynamicity of coastal morphology using geospatial and numerical approach. Shore-line on both sides of kasaragod river firth, laterally karnataka coast of the India, has modified following construction of break waters for fishing harbor. The break waters were constructed between 2010 and 2015 after which a severe change is observed in shore-line. Construction flaws were reported as a result of which strong waves were formed leading to the difficulty in launching boats into the sea. Coastal morphology needs to be further analysed to propose a more scientific and lasting solution. Shore-line is extracted from field surveyed data (supplied by Department of Harbour Engineering, Kerala). To ensure the forecast End Point Rate (EPR) and Linear Regression Rate (LRR) for shore-line data Digital shore-line analysis (DSAS) technique was applied and compiled for upto 2017 in response to the construction of a pair of breakwaters at river inlet.

Keywords—Breakwaters. Costal morphology, Shore-line transformation, DSAS.

STRENGTHENING OF RCC SLAB BY USING PRESTRESSED CARBON FIBRE REINFORCED POLYMER LAMINATE

Vaibhav Jadhav
Research scholar, Department of civil engineering,
Annasahebdange college of engineering &tecvhnology, Ashta, India
jjadhav35@gmail.com

Santosh Mohite
Assistant professor, Department of civil engineering,
Annasahebdange college of engineering &tecvhnology, Ashta, India

Abstract— The use of composite materials is more in repairing and retrofitting of concrete structures in the last few years, so that many of concrete structures would be strengthened by these materials. One of these applications are Carbon Fibre Reinforced Polymer (CFRP) material used in fortifying and retrofitting of strengthened solid structures. The primary explanation behind this is it is conceivable to get a decent reinforcing impact with a generally less work exertion. It is additionally conceivable to complete a reinforcing work without changing the appearance or measurements of the structure.

Keywords— CFRP, Flexural strength, Reinforced concrete slab, Epoxy adhesive, Deflection, Prestressed.

Assessment of Meteorological Drought Return Periods Over A Temporal Rainfall Change

Rajarshi Datta
Dept. of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka Surathkal, Mangalore, India
rajarshi123.rd@gmail.com

Abhishek A. Pathak
Dept. of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka Surathkal, Mangalore, India
abhipathak2013@gmail.com

Dr. B.M. Dodamani
Dept. of Applied Mechanics and Hydraulics
National Institute of Technology Karntaka Surathkal, Mangalore, India
bm.dodamani@gmail.com

Abstract—The purpose of the present study is to examine the homogeneity of rainfall and bivariate frequency analysis of drought considering change points in annual precipitation time series. Pettitt's test was applied for annual precipitation series at different grid locations over the Ghataprabha river basin. Meteorological drought is identified using the Standardized Precipitation Index (SPI) at a time scale of three months for the time period before the change point, after the change point and also considering the entire time period of 1950 to 2013. The joint distribution of drought properties is simulated using three families of Archimedean copulas, namely, Clayton, GumbelHouggard and Frank. Based on the results of goodnessof-fit statistics it was found that the Gumbel-Hougaard copula better represents bivariate drought properties when compared with other copulas. The joint distribution obtained from the copula is considered for computing joint return periods. The study gives valuable insight into drought risk management on a regional scale.

Keywords—change point, return period, meteorological droughts, spi, copula, pettitt test

A Study on Morphodynamic Nature of Muthalapozhi Harbour Using Geospatial Approach

Ammu John
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
ammujohn789p@gmail.com

KunhimammuParavath
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
kunhimammup@gmail.com

T Nasar
Department of Applied Mechanics and Hydraulics
National Institute of Technology Karnataka, India
t.nasar@gmail.com

Abstract— The coast is a dynamic zone where the atmosphere, ocean, and land interact. The dynamicity is accounted because of both natural and anthropogenic activities. Hence it is important to monitor the dynamicity of any fragile coastal stretch in a temporal basis. An attempt to study the dynamicity of coastal morphology using geospatial approach is made in this study. Shoreline on both sides of Muthalapozhi tidal inlet, which is located along the southwest coast of India, was modified after the construction of breakwaters for a fishing harbour. The fishing harbour work was initiated in 2002. Severe erosion at the immediate north of the breakwater and choking of harbour mouth due to spit formation was observed. The construction of modified breakwaters began in 2013, after resolving the deficiencies in the first phase. Construction flaws were again reported, resulting in the formationof strong waves leading to several boat accidents. Coastal morphology needs to be further analysed to propose a more scientific and lasting solution. End Point Rate(EPR) and Linear Regression Rate(LRR) are calculated in response to the construction. Shorelines were extracted from field surveyed data provided by Harbour Engineering Department. Average erosion rate on the Northern and Southern side of inlet before and after the construction of breakwater is obtained by the analysis of this data.

Keywords— Muthalapozhiharbour ; Shoreline change ; DSAS ; End Point Rate ; Linear Regression Rate ;

Hydrogeochemical Evaluation of Saline water Ingression along BelmaMicrowatershed, Dakshina Kannada District, Karnataka

Thangamani R.
Department of Civil Engineering
N.M.A.M. Institute of Technology Nitte, India
thangamani@nitte.edu.in

Radhakrishnan K.
Department of Civil Engineering
N.M.A.M. Institute of Technology Nitte, India
georadha@nitte.edu.in

Sindhu K.V.
Department of Civil Engineering
N.R.A.M. Polytechnic Nitte, India
kvsindhu.71@gmail.com

Abstract— Saline water ingression and the salinity hazards of the fertile lands in the micro watersheds near and far off the main river channel in the coastal district of Dakshina Kannada is a grave problem resulted due to the haphazard land and water management and excessive use of groundwater for the wet crop cultivation in this area. The current study aims to analyze the hydrogeochemical characteristics of water resources in a micro-watershed on the approach of Nethravathi River mouth to assess the surface and groundwater quality for domestic and agricultural purposes and the extent of their contamination. About twenty one water quality parameters and various ion concentration viz: temperature, pH, Turbidity, TDS, EC, Ca-H, Mg-H, TH, DO, BOD, Cl-, F-, SO42-, NO3-, CO32-, HCO3-, Fe, Ca2+, Mg2+, Na+ and K+ were analyzed to delineate the extend of saline water ingression. The result analysis shows enough evidences of saline water ingression in the study area. It is very much necessary to have a sustainable integrated micro watershed development approach through proper planning and management practice for the reclamation of this fertile micro-watershed from its salinity hazard and to go for any other development activities.

Keywords— Belma; Microwatershed; Hydro geochemistry; saline water ingression coastal Karnataka.

STUDIES ON CONCRETE AND PAVER BLOCKS PROPORTIONED BY RECYCLED CONCRETE AGGREGATES

Anand Kumar B.G[1]*, Dr Ravindra.R[2]
[1]*Assistant Professor, Department of Civil Engineering,*
Rashtreeya Vidyalaya college of Engineering, Bengaluru, Karnataka (India)
[2]*Associate Professor & Dean, Department of Civil Engineering,*
Rashtreeya Vidyalaya college of Engineering, Bengaluru, Karnataka (India)
**Author for correspondence: Anand Kumar B.G, Mobile: +91-9844755956,*
e- mail:anandkumarbg@rvce.edu.in

ABSTRACT: Major reason for increase in Construction and Demolition Waste (CDW) is due to construction, rehabilitation and demolition of civil engineering structures. CDW includes ceramic, masonry, bricks, concrete, glass, timber, steel, soil etc. The Department of Ministry of Environment, Forest and Climate Change notified the construction and demolition waste management rules. Based on survey data by the department shows that about 530 million tons of construction and demolition waste is generated annually. Hence concrete waste utilization as a partial replacement of fine and coarse aggregates may avoid illegal dumping and landfill. Present work is focused on utilization criteria of crushed concrete aggregates gained from CDW, in the production of concrete and paver blocks. This paper presents the properties of recycled fine and coarse aggregates of crushed concrete, sourced from local dump site. The recycled fine and coarse aggregates is used in part replacement with manufactured sand for various proportions 10, 20, 30 and 40% (by weight) for proportioning concrete and paver blocks. Blocks were cast at commercial manufacturing plant, Bengaluru, using commercial grade concrete and paver blocks casting machine which is used in mass production. Durability and Strength parameters of concrete and paver blocks are promising and found feasible to use. It was noticed that there is improvement in strength at a replacement level 30% of Recycled Fine Aggregate (RFA) and 20% of Recycled Coarse Aggregate (RCA) in blocks, however strength loss at higher replacement level was very minimum. Microstructure analysis has revealed the factors governing strength in blocks prepared by recycled aggregates. Costs of blocks manufactured using recycled aggregates are more economical in large scale production.

Keywords: Crushed concrete waste, Recycled fine aggregate, Recycled coarse aggregate, Concrete blocks, Paver blocks, Micro structural analysis, Cost saving.

An Overview on Assessment of Workability of Concrete Mixes in Indian Scenario

Udayakumar[1], Anand Kumar B.G[2]
[1]*Student, Post Graduate-Structural Engineering,*
Rashtreeya Vidyalaya college of Engineering, Bengaluru, Karnataka (India)
E-mail: udayakumarcv22@gmail.com
[2]*Assistant Professor, Department of Civil Engineering,*
Rashtreeya Vidyalaya college of Engineering, Bengaluru, Karnataka (India)
E-mail: anandkumarbg@rvce.edu.in

ABSTRACT: Concrete is one of the major components of a structure, particularly a multistoried structure, where it account for 30 to 50% of the total cost. The concrete workability has a direct control on productivity also ease to do work associated with concrete to the structure as a whole. In this context assessment of concrete workability assumes relevance. In countries like India, in sequence to characterize the different concrete mixes based on the workability value there will be some of the conventional workability test methods available. Practicing engineers, research institutes and laboratories measure the workability based on conventional test methods and proportion mixes based on obtained results only. Even though the concrete industries are upgrading day by day, the slump cone test has remain unchanged. The slump cone test is suited only for medium range workability assessment i.e. slump ranging between 25mm to 100mm. The Vee-Bee test method is suited only for low to medium workability of concrete mixes. Compacting factor test method is commonly applied as a role of friction between hoppers sides and concrete; however this test may not replicate the actual on site working conditions. However workability of concrete is measured separately for normal conventional concrete mixes and special concrete mixes using several devices manufactured by other codal provisions and guidelines. Measuring workability of Self-Compacting Concrete (SCC) is completely reliant on only EFNARC Guidelines in countries like India, since there are no BIS codal provisions available to assess workability. There is a strong need to develop one such apparatus which can measure workability of normal, special and SCC mixes. Present paper describes various opportunities in developing a simple device which is cost effective and less complexity in handling. Such device may help to evaluate workability of in-situ mixes and suiting the requirement of laboratory conditions, also trouble-free to measure workability of all kind of concrete mixes.

Key Words: Workability, Conventional Concrete mixes, Self Compacting Concrete, Apparatus

FEASIBILITY STUDIES BY USING LIGHT EXPANDED CLAY AGGREGATE AS PARTIAL REPLACEMENT FOR FINE AGGREGATE IN SELF COMPACTING CONCRETE

Punith Kumar[1],(M.Tech),Vageesh H.P.[2], M.Tech,,H. Eramma[3], PhD,Reena K[4]M.Tech

[1]*student,Post graduate structural engineering Department of Civil Engineering,R. V. College of Engineering, Bengaluru,VTU, Karnataka, India,*
E-mail: punithkumarpes@gmail.com
[2]*Assistant Professor, Department of Civil Engineering,R. V. College of Engineering, Bengaluru,VTU, Karnataka, India,*
E-mail: vageeshhp@rvce.edu.in
[3]*Associate Professor, Department of studies in Civil Engineering, UBDT College of Engineering, Davanagere, Karnataka, India.*
[4] *Research Scholar, Department of studies in Civil Engineering,UBDT College of Engineering, Davanagere, Karnataka, India*

Abstract- Self-Compacting Concrete (SCC) is a highly flow-able concrete which flows by its own weight and attains the compaction energy without influence of external vibrations, the areas at which flowing of concrete with in the thick reinforcement is a major issue such as; beam-columns joints, retaining walls, bridge abutments, piers and etc., to overcome this difficulty SCC was developed in Japan during 1980's. At present, scarcity of natural aggregate was a seriousissue, to fixthis various research were carried out and evidenced that usage of alternate materials as partial replacement for fine, coarse aggregate and even cement also resulted in producing sustainable concrete; with this overview, an attempt is made to design SCC mixes using Nan-Su's method by incorporating European Federation of National Associations Representing for Concrete(EFNARC) guidelines and to evaluate the effect of light expanded clay aggregates (LECA) on fresh and hardened properties of SCC mixes with varying percentage of fine aggregate content i.e., 10%, 20%, and 30%. The outcomes of this investigation are,SCC with 10 percentage replacement of LECA is feasible solution for future construction work and for sustainable development.

Keywords: SCC; LECA: EFNARC

Performance Based Economic Evaluation of Retrofitted Slabs with Different FRP's and different Configurations

Shubhalakshmi B S
Department of Civil Engineering,
Dayananda Sagar College of Engineering, Bangalore, India
shubhalakshmibs@gmail.com

H.N. Jagannath Reddy
Department of Civil Engineering,
Bangalore Institute of Technology, Bangalore, India
jagannath.priyadhi@gmail.com

Arjun Kasi
Department of Civil Engineering,
BMS College of Engineering, Bangalore, India
kasiarjun@gmail.com

Abstract— Restoring the strength and performance of the structural element has become the current topic of the research study. It is also been observed well established strengthening techniques are available for beams and columns such as section enlargement, jacketing, external bonding, near surface mounted techniques etc., whereas the available strengthening methods for the slabs are limited. The saturation of carbon fiber reinforced polymers or commonly known as CFRP composites and glass fiber reinforced polymer commonly called GFRP composites, encourages the research activity for the product development of an alternative material to be used in structural retrofitting and rehabilitation of structures. Most importantly materials which are economically viable are very much required for the developing country like India. Polypropylene fibers, which are very much used in the industries like mining, agriculture, fabric industries, sports, hospitals and chemical industries and find a limited applications in construction industry.

The economic analysis of the wrapping material was calculated based on the cost of the material, area of wrapping and strength achieved was considered during the analysis it was found that the percentage increase in the ultimate strength of the strengthened slabs using the plus and square wrapping configurations was in the range of 2.9% to 6.4%.

Keywords— Strengthening, fibers, rehabilitation, wrapping

Comparative Study on Behavior of CFST and CES Columns Using ABAQUS Software

Thripthi
Department of Civil Engineering, NMAM Institute of Technology Nitte, Karnataka, India
karkerathripthi@gmail.com

Ranjith A
Department of Civil Engineering, NMAM Institute of Technology Nitte, Karnataka, India
ranjith.anand70@gmail.com

Tanvi Rai A
Department of Civil Engineering, NMAM Institute of Technology Nitte, Karnataka, India
tnvrai07194@gmail.com

Sahana Suresh
Structural Consultant, Chikkamagaluru, Karnataka, India
sahanasuresh5@gmail.com

Abstract— The composite construction has always been the area of interest for structural engineers as the use of two or more material to make one structural member have always proved to be beneficial. The concrete filled steel tubes (CFST) and concrete encased steel (CES) columns are gaining popularity and have been adopted for the construction of high rise buildings. In the present work CFST columns, CES columns were analyzed which subjected to axial compression is loading. The columns are assumed to be having Fixed- free end and the loads are applied on the loading plate for even distribution of loads. The circular, square and rectangular shapes of columns are considered. CFST columns were considered for varying steel tube thickness 3mm, 5mm and 7mm and the I-section selected is ISMB 100 for CES columns. CFST and CES columns were analyzed separately. The behavior of these columns and their ductility is studied. The analysis is carried out using the finite element software ABAQUS. The modeling and meshing is done in the software and analyzed and the loads versus deformation graphs are plotted for each column. The ductility factor and load carrying capacity for all the CES and CFST columns are compared. The circular CFST column with 7mm tube thickness is found to be the better one in terms of ductility and load carrying capacity.

Keywords—CFST, CES, Ductility Factor, Axial Deformation, Load carrying capacity, Tube thickness, ABAQUS

An Experimental study on Concrete with partial replacement of cement by fly ash and natural aggregates by recycled aggregates

Sachin U
Assistant Professor
Department of Civil Engineering
St. Joseph Engineering College Vamanjoor, Mangaluru, India
sachinu@sjec.ac.in

Stephy K S
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
stephyks96@gmail.com

Ruben Santhmayor
Department of Civil Engineering
*St Joseph Engineering College Vamanjoor, Mangaluru, India*rubensanthmayor@gmail.com

Aditya Rao H
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
raoadithya9764@gmail.com

MariyaRebeka Gregory Gomes
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
gomesrebeka9479@gmail.com

Abstract - This paper represents an experimental study on concrete blocks with partially replacing natural aggregates by recycled aggregates and cement by fly ash. The use of waste materials such as construction and demolition waste and fly ash is attaining a lot of importance in the present society as it helps to cut down the waste accumulation and also scale down the space required for disposal. We have determined the properties of recycled concrete based on the strength criteria by replacing 15%, 30% and 45% of natural aggregates by recycled aggregates and 10% cement by fly ash for all the trial mixes. The research was carried out by a compressive strength test for the moulds at 7, 14 and 28 days and tensile strength test for the moulds at 28 days respectively. From the results, the studies were able to obtain an economical and eco-friendly concrete block with fairly high strength compared to the conventional blocks.

Keywords—recycled aggregate, fly ash, economical, ecofriendly

Time Invariant Reliability Analysis of RC T-Beam Bridge Girder– Limit State of Strength in Flexure

Ranjith A
Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka, India
ranjith.anand70@gmail.com

Thripthi
Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka, India
karkerathripthi@gmail.com

Tanvi Rai A
Department of Civil Engineering
NMAM Institute of Technology Nitte, Karnataka, India
tnvrai07194@gmail.com

K Manjunath
Department of Civil Engineering
Malnad College of Engineering Hassan, Karnataka, India
kmnrpur@gmail.com

Abstract—The purpose of structural design is to fix the dimensions of a structural member, to safely withstand the loads anticipated during its life cycle and to serve the intended purpose satisfactorily throughout its service life in the environment it is built for. The main aim of present work is to determine the probability of satisfactory performance of flanged reinforced concrete beams in limit state of strength in flexure. For this purpose, two methods namely simulation approach and analytical approach has been made use of. For the study purpose, standard T- beam bridge cross sections for different spans as recommended by MORTH has been made use of. The typical load combinations as specified in IRC: 62017 is considered. Also, the special vehicle load which was introduced in recent code IRC: 6-2017 is also considered to check the performance of bridge beams against limit state of strength in flexure. The various basic random variables are assumed to be statistically independent normal and nonnormal random variables. The moment of resistance is found to follow normal distribution, external moment found to follow Type -1 distribution and the safety margin is found to follow lognormal distribution. The reliability index value tends to decrease with increase in span.

Keywords—reliability index, flexure, probability, T-beam bridge

Overlay Design of Flexible Pavements Using Benkelman Beam Deflection Method- A Case Study

Ashwini Prabhu
Dept. of Civil Engineering NMAM Institute of Technology Nitte, India
ashwini.prabhub@gmail.com

Arpith SP
Dept. of Civil Engineering NMAM Institute of Technology Nitte, India
arpithsanthoshp@gmail.com

Vahida KK
Dept. of Civil Engineering NMAM Institute of Technology Nitte, India
vahidakadark@gmail.com

Dishanth Kumar
Dept. of Civil Engineering NMAM Institute of Technology Nitte, India
dishanthg123@gmail.com

Dr.Arunkumar Bhat
Professor Dept. of Civil Engineering NMAM Institute of Technology Nitte, India
arun.bhat@nitte.edu.in

Dr. Anil Kumar
Assisstant Professor Dept. of Civil Engineering NMAM Institute of Technology Nitte, India
kumaranil@nitte.edu.in

Abstract-The development in commercial, residential and industrial areas has led to an increase in traffic load further causing the deterioration of the pavements. To keep the pavements in good serviceable condition, it is necessary to carry out the functional and structural evaluation of the pavement. In the present study the functional and structural evaluation was done by visual observation of the pavement and Benkelman Beam Deflection (BBD) technique respectively on a village road in Nitte and SH 37 in Hosmar, Udupi District. Soil subgrade samples were collected from both the sites and soil tests such as compaction and CBR were carried out on the soil subgrade. The Benkelman Beam Deflection data were analyzed. The overlay design was selected based on the characteristic deflection and design traffic obtained for the respective pavements.

Keywords—Functional evaluation, Structural evaluation, Flexible pavement, BBD technique, overlay

An Experimental study of interlocks by partial replacement of coarse aggregate by E-waste and cement by fly ash

Sachin U
Assistant Professor
Department of Civil Engineering
St. Joseph Engineering College Vamanjoor, Managaluru, India
sachinu@sjec.ac.in

Anaswara Balan
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
anaswarabalan03@gmail.com

Sivatha S
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
sivathasudhi@gmail.com

Alisha Jose
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
alishajose20@gmail.com

SonalPreetiMoras
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru, India
sonalpreetimoras@gmail.com

Abstract- Under this paper, a study on concrete interlocks by partially replaced coarse aggregate with E-waste and cement by fly ash has been carried out. The E-waste is recycled and used as a construction material. Determination of recycled concrete interlock based on the strength criteria by replacing 10%, 20% and 30% of natural aggregates by Electronic waste and 10% of cement by fly ash has been explained in this paper. Tests were conducted for the age of 3, 7, and 28 days. An economical and ecofriendly concrete interlock with fairly high strength interlocks compared to the natural interlocks were obtained from this study.

Keywords—E-waste, fly ash, interlocks, eco- friendly, compressive strength

Vulnerability Assessment of Step-back and Set back Buildings on Different Slopes under Earthquake Loading

Chidanand Bidnalamath
M.Tech Student (Structures)
Department of Civil Engineering,
NMAM Institute of Technology, Nitte,
Karkala Taluk, Udupi District, India.
chidub22@gmail.com

Sabyath Shetty
Assistant Professor
Department of Civil Engineering,
NMAM Institute of Technology, Nitte,
Karkala Taluk, Udupi District,
*India.*shettysabyath@nitte.edu.in

Pradeep Karanth
Assistant Professor
Department of Civil Engineering,
NMAM Institute of Technology, Nitte,
Karkala Taluk, Udupi District, India.
pradeepkaranth@nitte.edu.in

Shanmukha Shetty
Assistant Professor
Department of Civil Engineering,
NMAM Institute of Technology, Nitte,
Karkala Taluk, Udupi District, India.
shettyshanmukha@nitte.edu.in

Abstract—the seismic responses of structures on sloping areas are fairly different as compared to the flat ground. Stepback and set back structures has geometrical irregularity, hence these structures are more vulnerable to earthquakes on inclined ground. In this paper, an attempt has been made to evaluate the seismic performance of reinforced concrete buildings on flat and sloping ground with sloping angles such as 20˚, 30˚ and 40˚. The response spectrum method of analysis has been performed using by ETABS v 17.0.1. The earthquake resistance code IS 1893(Part 1):2016 and IS 13920:2016 has been referred in this study. Results are discussed in terms of base shear, storey drift, storey stiffness, short column effect and overturning moment for the plain and inclined ground with different inclinations. In inclined ground structures under seismic loads, the short column effect is a common problem; hence the discussion of critical issues of step back and set back structures is presented for different slope angles.

Keywords—Step back and set back buildings, stiffness, slope.

Effect of X Bracings on Seismic Response of Set Back and Step Back Buildings on plain and sloping Ground

[1st] Harsha Mesta
M.Tech student
Department of Civil Engineering
NMAM Institute of Technology, Nitte
Karkala Taluk, Udupi District, India
574110
harshamestha43@gmail.com

[2nd] Sabyath Shetty
Assistant Professor
Department of civil Engineering
NMAM Institute of Tecchnology, Nitte
Karkala Taluk, Udupi District, India
574110
shettysabyath@nitte.edu.in

[3rd] Sushanth Bhandary
Assistant Professor
Department of Civil Engineering
NMAM Institute of Technology, Nitte
Karkala Taluk, Udupi District, India
574110
sushanth.bhandary@nitte.edu.in

[4th] Bhojaraj B E
Assistant Professor
Department of Civil Engineering
NMAM Institute of Technology, Nitte
Karkala Taluk, Udupi District, India
574110
be.bhojaraj@nitte.edu.in

Abstract: RC Framed buildings built on hill slopes shows different structural behaviour in comparison to that on the plain ground. The structures on inclined ground attract more shear force in columns and torsional moments due to varying column lengths. This paper reflects on the seismic reaction of structures on the plain and sloping ground with different building configuration such as setback, stepback and setback step-back buildings and also the use of X bracing on the seismic resistance of the structures. The linear dynamic analysis of the structures on inclined and plain surface has been carried out under earthquake loading and the results are recorded. This paper concludes that combination of step-back set back building behaved well against seismic forces and the use of X type of braces in a building built on sloping ground enhanced the resistance against storey displacements, drifts and storey shear in structures.

Keywords: Sloping ground, X braces, Conventional building, setback building, set back step-back building.

ESTIMATION OF ARECANUT CROP EVAPOTRANSPIRATION RATE USING REMOTE SENSING DATA SETS

Bhojaraja B.E
Civil Engineering Department.
N.M.A.M.I.T, Nitte, Karkala, Udupi, India.
be.bhojaraj@nitte.edu.in

Anaswara Das S R
Civil Engineering Depart Government College of Engineering Kannur, India
anaswaradassr@gmail.com

Amba Shetty
Applied Mechanics and Hydraulics Department
N.I.T.K-Surathkal
Mangaluru, India
amba_shetty@yahoo.co.in

Abstract— Arecanut is a plantation crop sustains for decades and its crop water demand varies with the age. For scheduling and management of irrigation water, crop water requirement information is important. To compute the crop water requirement, estimation of evapotranspiration is crucial. The term Evapotranspiration (ET) refers to transport of water into the atmosphere from soil (soil evaporation) and vegetation (transpiration) surfaces. It is a most important component of hydrological balance and also the most difficult factor to quantify. Crop water need is the amount of water required for balancing loss due to evapotranspiration. There are different methods proposed by researchers for the estimation of evapotranspiration. The conventional methods of estimation of evapotranspiration from ground data are tedious. In the last decades, the advancement in remote sensing data provides evapotranspiration estimates in a global scale. The invention of thermal remote sensing has benefitted greatly since it reduces the field data requirement for estimation of ET. It also helps to understand spatial distribution of landmass and different estimates also in estimation of evapotranspiration over a larger extent timely and periodically. In this study to estimate Arecanut crop evapotranspiration Hargreaves Samani, Penman Monteith and Priestly Taylor methods were used and compared. Arecanut crop water evapotranspiration estimated form Landsat 8, MODIS reviled the similar range of values i.e. 3 to 4.45 mm/day. The study area covers an area of 835.3 hectares of Arecanut crop and the gross crop water need is found to be 23059 m3.

Keywords—Arecanut crop, Age based crop water requirement, Classification, Evapotranspiration.

Stabilization Methods For Locally Available Soil-A Review

Ashmitha N M
PG Student (CCT) Dept of Civil Engineering
NMAM Institute of Technology, Nitte, Karkala Tq.,
Udupi District. Karnataka, India.
ashmithanm21@gmail.com

Shriram Marathe
Assistant Professor, Dept of Civil Engineering
NMAM Institute of Technology, Nitte, Karkala Tq.,
Udupi District., Karnataka, India.
ram.nmamit@gmail.com

Dr. Arun Kumar Bhat
Professor, Dept of Civil Engineering
NMAM Institute of Technology, Nitte, Karkala Tq.,
Udupi District., Karnataka, India.
arun.bhat@nitte.edu.in

Abstract— The method or technique of changing the physical, chemical, and mechanical property of a natural soil, in order to improve their tensile strength, bearing capacity and overall performance, by using controlled compaction, proportioning, in addition of suitable stabilizer and admixture is known as stabilization of soil. The major application of soil stabilization is in the field of pavement subgrade, which is very much essential to improve its strength, bearing capacity and performance to a level better than the existing condition. By modifying the sub-grade properties, the economy can be achieved in pavement construction by having reduced upper crust thickness. The objective of this paper is to review the various papers on the techniques already adopted for improving the engineering properties of soil to be used as a effective subgrade material.

Keywords—Locally Available soil, Subgrade, CBR, UCS, Stabilization

Assessment of Solar Power Potential Mapping In Telangana State using GIS

Manish S Dharek
Dept. of Civil Engineering
BMSIT&M Bengaluru, India
manish.shashikant@gmail.com

Manjunath V Kadalli
Dept. of Civil Engineering
BMSIT&M Bengaluru, India
kadallimanjunath@gmail.com

Anant G Pujar
Dept. of Civil Engineering
JIT Bengaluru, India
anant.pujar@jyotyit.ac.in

Prashant C Sunagar
Dept. of Civil Engineering
RIT Bengaluru, India
prashant.sjce@gmail.com

Sreekeshava K S
Dept. of Civil Engineering
JIT Bengaluru, India
sreekeshava.ks@jyothyit.ac.in

Abstract— Solar energy replacing conservative nonrenewable energy is being witnessed in often around the world. Solar energy has a massive prospective in a humid country like India [2]. Most parts of the country get around 300 sunshiny days in a year with 8 hours of daily sunlight. Presently, one of the most interesting problem is how to mend the effectiveness of generating solar energy. Before installing solar panels, evaluating where solar panels should be positioned can considerably benefit panel performance. The present study is aimed at carrying out site selection analysis for setting up of solar panel using Geographical Information Systems (GIS). Telangana is a state which ranks fourth in terms of capacity to harness and utilize solar energy. The project is aimed at mapping the areas with high solar energy potential both at macro and micro level. The solar irradiation data (GHI and DNI), land-use data and Digital Elevation Model (DEM) have been used in GIS environment while retaining land-use criteria and topography to omit unsuitable sites for harnessing solar energy[2]. The study carried out concludes that total suitable area of 11520.60 km² at macro analysis for economical and effective harnessing of Solar Power.

Keywords— Geographic Information Systems, Solar energy potential, site-selection analysis;

FLOOD FLOW ANALYSIS IN MAHADAYI RIVER BASIN

Mustafa Y[1] , Taliburrehman[2], Tousif J[3], Gayatri[4] , Sangami S[5]

[1234]UG students, Department of civil Engineering, Jain college of Engineering , Belagavi

[5]Associate Professor, Department of civil Engineering, Jain college of Engineering, Belagavi

Corresponding author, Tel:+91 8904917797 (Mustafa Yadawad),

+91 9945754311 (Sangami S).

Email addresses: mustafa65558@gmail.comsanjeevenv08@gmail.com

Abstract— The purpose of this study is to estimate the river volume by considering the flooding action on the sensitive zones along the Malaprabha river basin. This study is very much essential as the discharge is going to increase by the substitution of extra water from the Mahadayi basin. Hence, the study has been carried out using QGIS and surfer software. The sensitive zones are identified near Naveeltirth dam, Khanapur and Budihal regions. There for the advance flood controlling technique can be adopted to prevent the losses.

Partial Replacement of Fine Aggregate by Ceramic Balls in Concrete

Mr. Guruprasad Naik
(B. E. Student)
Department of Civil Engineering
N.M.A.M. Institute of Technology, NITTE,
Affiliated to VTU
Udupi, India
naikguru.kwr@gmail.com

Mr. XavierG. Pereira
(B. E. Student)
Department of Civil Engineering
N.M.A.M. Institute of Technology, NITTE,
Affiliated to VTU
Udupi, India
xavierpereira19@yahoo.in

Mr. Punith L
(B. E. Student)
Department of Civil Engineering
N.M.A.M. Institute of Technology, NITTE,
Affiliated to VTU
Udupi, India
punithltumkur@gmail.com

Ms. Sheethal Shetty
(B. E. Student)
Department of Civil Engineering
N.M.A.M. Institute of Technology, NITTE,
Affiliated to VTU
Udupi,
*India*sheethalshetty151@gmail.com

Mr. Pradeep Karanth
(Asst. Prof.)
Department of Civil Engineering
N.M.A.M. Institute of Technology, NITTE,
Affiliated to VTU
Udupi, India
pradeepkaranth@nitte.edu.in

Mr. Janakaraj M.
(Asst. Prof.)
Department of Civil Engineering
N.M.A.M. Institute of Technology, NITTE,
Affiliated to VTU
Udupi, India
janakaraj@nitte.edu.in

Abstract—River sands a non-renewable resource is used as a fine aggregate in concrete which is called filler material that fills the voids in concrete. This paper provides outcomes compressive strength of concrete by using a ceramic ball as substitutes of fine aggregate that is compared with nominal mix concrete. Here the ceramic ball is a commercial produced in industries. The report includes a chemical test of the substitute, it is having 73% of silica and 0.7% of alumina. Zone I and Zone II is selected as fineness modulus of sand for calculation of nominal mix design and partial mix design. per the 28 days compressive strength result, 50 replacement of fine aggregate obtain minimum strength in comparison with a nominal strength of concrete, hence this waste material can be used to replace 50% and 100% of fine aggregate in the manufacturing of concrete. The main purpose of this project is to find a way to dispose of the waste product and to reduce the use of sand as fine aggregate in manufacturing of concrete.

Keywords— Compressive strength, Ceramic ball, Concrete

Effect of different Base Isolation Techniques in Multistoried RC Regular and Irregular Building

Prashant Sunagar
Department of Civil Engineering
Ramaiah Institute of Technology
Bengaluru,Karnataka, India
Prashant.sjce@gmail.com

Dr. Aravind Bhashyam
Department of Civil Engineering
Christ University
Bengaluru, Karnataka, India

Manish Shashikant
Civil Engineering
DeptBMSIT&M
Bengaluru

Sreekeshava K S
Civil Engineering Dept
Jyothy Institute Of Technology
Bengaluru

Abhishek Chaurasiya
Civil Engineering Dept
MSRIT
Bengaluru

Abstract. Base confinement system for a structure is acquainted to decouple the building structure from possible movement incited by the movement of the seismic tremor, keeping the building superstructures from retaining the quake vitality. Base isolator increases the regular time period of the general structure and diminishes its shear increasing speed reaction to the seismic movement. In this explanatory examination, a ten storey Reinforced Concrete (RC) building with Lead elastic bearing, High Damping elastic bearing and Triple contact pendulum framework bearing is acquainted with the structures and correlation is made between fixed base and the base secluded structures. Analysis has been done using FEM Software ETABS 2015. The analysis is performed to check the lateral displacement, inter storey drift, storey shear and storey acceleration. It is found from the investigation that reaction of working to lateral load diminishes while modular period is expanded in both X and Y bearings. Furthermore, the response of the structure can be reduced by the use of High Density Rubber Bearing (HDRB) and Friction Pendulum System (FPS) isolators.

Keywords: Seismic Isolation, LRB, HDRB, TFPB, Dynamic Analysis

Experimental studies on Geosynthetic Vertical Barrier around the Dumpyard

Dr.Nalini Rebello
Department of Civil Engineering
St Joseph Engineering College Vamanjoor, Mangaluru
nalinir@sjec.ac.in

Akarsh
Department of Civil
St Joseph Engineering College Vamanjoor, Mangaluru
akarshhr012@gmail.com

Sayed Aseem
Department of Civil
St Joseph Engineering College Vamanjoor, Mangaluru
sayedaseem0708@gmail.com

Harikiran R
Department of Civil
St Joseph Engineering College Vamanjoor, Mangaluru
18harikiran@gmail.com

ShrikanthVasani
Department of Civil
St Joseph Engineering College Vamanjoor, Mangaluru
rahulvasani09@gmail.com

Abstract— The water sources surrounding the Mangalore dumpyard have been highly contaminated by the leachate percolating to the water bodies as it contains high content of toxic metals like Lead, Mercury, Cadmium, Arsenic etc. The Geo-synthetic Clay liner at the bottom of the dumpyard is worn out and hence there is direct percolation of water into the water bodies. Geo-synthetic membranes is latest and the most effective for containing the contamination. In this paper the use of Geo-synthetic membrane or simply Geo membrane as a filter material for filtering the toxic metals is explained. A miniature model of the dump yard is prepared and Geo membranes were laid around the periphery of the model. Geo membranes like polypropylene of matrix density 500,600,700 have been used and a considerable reduction in contamination percentage has been obtained.

Keywords— Dumpyard, Geo-synthetics, Vertical Barrier

Development of Water Filtration Unit Using PVA Based Composite Membrane and Fly Ash

Dr.Nalini Rebello
Department of Civil
St Joseph Engineering College
Mangaluru,India
nalinir@sjec.ac.in

Mahima S Rao
Department of Civil
St Joseph Engineering College
Mangaluru,India
5mahimasrao5@gmail.com

Melroy Royston D'Souza
Department of Civil
St Joseph Engineering College
Mangaluru,India
dsouzamelroy7@gmail.com

Mahesha S M
Department of Civil
St Joseph Engineering College
Mangaluru,India
maheshmanju97@gmail.com

Vaishnavi T Rajeev
Department of Civil
St Joseph Engineering College
Mangaluru,India
vaishnavirajeev96@gmail.com

Abstract— Surface water sources have become highly contaminated due to the presence of undesirable substances making unfit for consumption and other uses. The concentration of impurities can be reduced by several methods. Membrane technology is the latest and the most effective one. In this paper, Glutaraldehyde grafted Chitosan-PVA polymer composite membrane have been synthesized and characterized. Solution casting method has been used to synthesis the membrane. PVA is dissolved in distilled water and then Chitosan powder is added to the solution. Membrane is fabricated and then grafted with Gluaraldehyde. Scanning Electron Microscopy (SEM) was used to characterize the developed composite membrane in terms of morphology and performance. Water optic studies were carried out to study the pore size of membrane. This paper is aimed at developing a simple water filtration unit using adsorbents like coarse aggregate, activated Charcoal sand, and Composite membrane.

Keywords— Chitosan; Membranes; Permeability; PVA; Glutaraldehyde; Characterization; Fly ash; Adsorbents

Compatibility study of soil-cement concrete in soil retaining structures – A Review

Mahima S Rao,
UG Student
St Joseph Engineering College,
Vamanjoor
Email:
5mahimasrao5@gmail.com

Adithya Rao H,
UG Student,
St Joseph Engineering College,
Vamanjoor
Email:
raoadithya9764@gmail.com

B Yajnheswaran
Associate Professor,
St Joseph Engineering College,
Vamanjoor
Email:
yajnheswaranb@sjec.ac.in

Abstract-The post study in the implication of soil cement as a construction material reveals that, it can have a remarkable applications in the civil engineering construction. In this regard a literature survey has been done on various application of soil cement as mortar, masonry wall, in slope protection works, controlling seepages in lakes, water storage reservoirs and ash settling ponds, foundation stabilization and pipe bedding etc. Perusal of literature reveals that very few investigations were done in soil cement – concrete in earth retaining structures. The improvement of locally available soils with cement can provide great advantages, including avoiding the need to borrow volumes of appropriate material and disposing of the local soil in deposits. Replacing of sand with fully or partially with cement in concrete can be the one of the solution to overcome the scarcity of sand in construction. Hence in this paper an attempt has been done to highlight the various studies done in the soil-cement to improve the tensile as well as compressive strength. The study also suggests that soil cement concrete has a remarkable application in earth retaining structures.

Keywords- soil-cement, tensile strength, compressive strength, porosity, mortar, stiffness etc.

Analytical Investigations on Fly ash based SFRSCC Exterior Beam-Column Joint using ANSYS

Nambiyanna B
Civil Engineering Dept.
Ramaiah Institute of technology,
(VTU Belagavi)
Bengaluru, India
nambiyanna1@gmail.com

Prabhakara R
Structural Engineering Division
Department of PG Studies,
VTU,
Belagavi,590018,
Karnataka, India
r.prabhakara@gmail.com

MujamilKudachi
Civil Engineering Dept.
Ramaiah Institute of technology,
(VTU Belagavi)
Bengaluru, India
mujamilk77@gmail.com

Abstract—Failure investigation studies on a large number of buildings exposed to earthquake loads revealed thatBeam-Column Joint (BCJ) is one of the critical structural zones in the structure. The response of the structure under the earthquake loads mainly depends on the behavior and performance of the BCJ. It has to be designed and detailed properly to certify safety and serviceability of the structure under various earthquake loads. It has been observed from the literature that the failure mechanism is brittle in nature at BCJ is due to bond and shear failure. Formation and propagation of shear cracks inside the critical zone of BCJ is the onset of progressive shear failure mechanism. Several technique and procedures have been adopted to prolong the onset of progressive shear failure mechanism. Also, the introduction of fibers inside the critical zone of the BCJ proved to be very effective. In the current analytical investigation, an effort has been made to demonstrate the influence of fibers in BCJ using the Steel fibre Reinforced Self Compacting Concrete (SFRSCC) with 0.5% steel fibers and compared over Normal Concrete (NC). Analysis of BCJ was carried out using ANSYS 15.0 program using the stress-strain relationship available from the literature. Load response curves have been plotted to demonstrate a change in the flexural behavior, energy absorption and ductility index are also evaluated. The obtained analytical results are compared with the experimental values and it was observed fibers were effective in SCC compared over NC.

Keywords—Beam-Column Joint (BCJ), Self-Compacting Concrete (SCC), Stress-Strain Curve, Ductility Index, Energy Absorption

Comparison of Soil Structure Interaction effect on Regular and Irregular Buildings with Soil Stratum

Mr Govinda Krishna[1], Kavya P C[2], Madhusudhana B C[2], Sushma Dsouza[2], Rahul Dias[21]*Assistant Professor,* [2]*UG Students,*

St Joseph Engineering College, Vamanjoor

Corresponding Email: govindak@gmail.com

Abstract - The purpose of this work is to study the behavior of regular and irregular structures subjected to static loading considering the effect of 'Soil-Structure Interaction'. In this paper, displacements and differential settlements in buildings with Ground (G), (G+2) and (G+5) floors resting on soft and hard soil layers is presented. Static nonlinear modal analysis is carried out under earthquake loading. The seismic analysis may be easily done using software other than ANSYS. The study reflects that, the lateral deformations depend on soil conditions beneath and cannot be ignored.

Key Words: ANSYS Mechanical APDL, Soil structure interaction, , Regular and Irregular Structures.

Comparative Studies on Flexural Strength of Conventional and Alkali Activated Masonry ElementsDesigned to Field Mix

Sahithya S Shetty
Department of Civil Engineering NMAM Institute of Technology, Nitte, Karkala Taluk,Udupi District, India.
sahithyamysty9@gmail.com

Shriram Marathe
Department of Civil Engineering NMAM Institute of Technology, Nitte, Karkala Taluk, Udupi District, India.
ram.nmamit@gmail.com

Dr. I R Mithanthaya
Department of Civil Engineering NMAM Institute of Technology, Nitte, Karkala Taluk, Udupi District, India.
mith9999@yahoo.com

Abstract— Due to degradation and non-availability of the natural resource, a numerous research is under taken to find a sustainable and ecofriendly construction material. One of the way to achieve this is by replacing the major materials of the normal cement concrete, completely or partially with different materials using low cost, easily available industrial byproducts or waste material. Considering all these facts, the present study focus on an alkali activated cement with the complete substitution of conventional cement binder with GGBS, fly ash and glass powder for the production of standard solid masonry blocks of standard size. In the study, locally available quarry dust is used as fine aggregates as a complete substitution of river sand. This investigation is aimed to study the strength aspects such as compressive strength, split tensile strength and flexural strength of the masonry blocks as per IS 2185-1-2005. As per as the results obtained, it is revealed that alkali activated concrete masonry blocks have superior strength aspects when compared to OPC concrete masonry blocks.

Keywords— GGBS, Fly-ash, Alkali activation, Compressive strength, Tensile strength, Flexural strength

A Study on Structural Characteristics of Sisal Fibre Reinforced Concrete

Mr. Mithun K
Assistant Professor Department of Civil Engineering KIT Tiptur India
mithun.kcv@gmail.com
Mr. Sundip Shenoy
Assistant Professor Department of Civil Engineering NMAMIT,Nitte India
sundipsheony@nitte.edu.in
Mr. Pramodh P
M.tech Student Department of Civil Engineering NMAMIT, Nitte
pramodh.pn25@gmail.com

Abstract— Concrete is strong in compression but weak in tension. So we will provide the reinforcement to the concrete. Majorly steel is used as the reinforcement. Many of the researches are in progress to find a substitute to this material. Many investigations proposed artificial fibers. The study focuses on the compressive strength, split tensile strength, performance of the blended concrete containing Na2Co3 treated sisal fiber. In this project study of Na2Co3 treated sisal fibers for 5 days on the strength parameters normal concrete had been carried out by varying percentages of 0%, 0.5%, 1%, 1.5%and 2% for M30 grade of concrete design by using IS10262-2009. Concrete cubes and cylinder are tested at the age of 7, 14, and 28 days of curing. From the experimental investigations, it has been observed that, the optimum percentage of Na2Co3 treated sisal fibre is 1% for M30 grade.

Keywords— Natural Fiber Reinforced Cement (NFRC), Sisal, Manufactured sand, Sodium carbonate (na_2co_3)

A REVIEW ON BIODETRIORATION OF CONCRETE

Ms. Lavanya A R
Dept. of Civil Engineering NMAM Institute of Technology Karkala, India
lavanyaramanna753@gmail.com

Ms. Raksha Rajani DSouza
Dept. of Civil Engineering NMAM Institute of Technology Karkala, India
rakshadsouza@gmail.com

Mr. Janakaraj M
Assistant Professor, Dept. of Civil Engineering NMAM Institute of Technology Karkala, India
janakaraj@nitte.edu.in

Abstract— Concrete is one of the strongest construction materials used all over the world. But maintaining durability of concrete has become a challenge in present scenario. Durability is affected by various factors, mainly bio-deterioration. This paper concludes how micro-organisms effect different parameters of concrete such as pH, thickness, weight, dimensions, composition etc. How to control the degradation using different alternatives such as fly-ash, corrosion inhibitors, special cements and nanoparticles.

Keywords— concrete, biodeterioration, inhibitors, durability, microorganisms

Composting in small laboratory foster: performance of the compost with and without using seeding material under aerobic condition

Monisha K Y
M.Tech in Construction Technology
Department of Civil EngineeringNMAM Institute of Technology Nitte, Karkala, Udupi
monishaky998651@gmail.com

Prasanna G
Assistant Professor
Department of Civil Engineering
BMS Institute of Technology & ManagementYelahanka, Bangalore
prasannag@bmsit.in

ABSTRACT: In this research work the performance of compost with and without using seeding material under aerobic condition is carried out. The compost without seeding material consists of vegetables: saw dust (4:1) and compost with seeding material consists of vegetables: saw dust: seeding material (cow dung and tertiary sludge) (4:1:1) ratio. In this work 3 large buckets of 15 liters and 3 small buckets of 5 liters capacity are considered and 3 small buckets are kept inside the large buckets. Small drill holes are done at the bottom of the small buckets to allow the leachate to collect at the bottom of the large bucket. The large size buckets are also drilled at the neck in order to maintain proper aerobic condition. In this process aerobic composting condition is considered and passive aeration is done through the drilled holes at top of the large buckets. In this process the emission of methane is not possible due to the maintance of aerobic condition will result in less pungent smell when compared to anaerobic composting. This aerobic composting is done for 90 days and the parameters like temperature, pH and moisture content is measured at certain intervals. The objectives of this research paper is to study the performance of the aerobic composting of vegetable wastes and saw dust and comparison of rate of composting with and without seeding material like cow dung and tertiary treated sludge. The rate of composting was same in all three containers. The maximum temperature obtained was 44.2oC, C/N ratio of the compost 1, 2 and 3 is 11.30:1, 12.51:1 and 10.93:1 respectively which serves as manure.

Keywords: Aerobic respiration, C/N ratio, seeding material.

Feasibility study on Geotextiles in slope stability - A Critical Review

Monisha K Y
PG Student Professor Assistant Professor
Dept. of Civil Eng. NMAMIT , Karkala, Udupi
monishaky998651@gmail.com

Dr. Arun Kumar Bhat
Dept. of Civil Eng.NMAMIT , Karkala, Udupi.
arun.bhat@nitte.edu.in

Dr. Anil Kumar
Dept. of Civil Eng., NMAMIT , Karkala, Udupi.
kumaranil@nitte.edu.in

Abstract: The natural soil is one of the fundamental materials which play a vital role in the construction activities related to civil engineering. In order to find the serviceability of existing soil structure such as slope, embankment, foundation, etc., the preliminary step is to analyze and design safety factor and parameter affecting the slope stability through STABLE, SEEP/W and SLOPE/W, FEM software. An effective reinforcement approach of slopes can be achieved by using Geotextiles as reinforcement material. In this paper feasibility of using Geotextile in slope stability have results in increasing the factor of safety and provided proper drainage system. Determination of maximum force that can be resisted by Geotextile.

Key word: Geotextile, stability, factor of safety.

GROUNDWATER MONITORING AND FLUCTUATION MAPPING USING RS AND GIS TECHNIQUES FOR BENGALURU NORTH TALUK, KARNATAKA, INDIA.

Nanjundi Prabhu Dr.M.Inayathulla
Assistant Professor Professor
Civil Engineering Department Civil Engineering Department
NMIT, Bengaluru, India UVCE, Bengaluru, India
Email:nanjundiprabhu@gmail.com Email:drinayath@gmail.com

Abstract:-

In the present study the overexploitation of Groundwater leads to problem in water supply and ill effects to human health. Hence global awareness should be given to the community regarding recharge and recycle of water. The modern methods of groundwater monitoring and mapping helps for the recharge and Groundwater table management. The water quality and quantity analysis should be done for the management of sustainability of groundwater, Hence Remote sensing and GIS techniques helpful for the mapping and sustainability of Groundwater recharge and management for Bengaluru North taluk, Karnataka. In this study we analyzed water levels for past 19 years and mapped for every 5 years and analyzed the Groundwater changes and precautionary measures can be taken, Groundwater Level fluctuation changing in the study area during 2001, 2006, 2011, 2016 ,from these maps we identified very good groundwater potential zones and poor groundwater zones, so we suggesting recharge structures for low groundwater potential zones like check dams, nala bunds, percolation ponds for cultivated land and roof top harvesting for urban areas.

Key words: GIS, Mapping, Groundwater table.

GROUNDWATER QUALITY ANALYSIS OF HARD ROCK TERRAIN IN BENGALURU NORTH TALUK, KARNATAKA, INDIA.

Nanjundi Prabhu Dr.M.Inayathulla
Assistant Professor Professor
Civil Engineering Department Civil Engineering Department
NMIT, Bengaluru, India UVCE, Bengaluru, India
Email:nanjundiprabhu@gmail.com Email:drinayath@gmail.com

Abstract:
In the present study we Analysed Groundwater quality of Hard rock terrain in Bengaluru North, Karnataka, India. For the present study areas affected by industrialization were selected to measure the quality of groundwater for determining its fitness for domestic use. Bore well samples from each part of the study area were analysed for Physico - chemical variations and quality of groundwater. Comparison of Physico - chemical analysis results with Indian Standard drinking water limits shows that all groundwater samples except few are fit for drinking and irrigation purposes. The average value of pH of five villages is 7.5-8.0 which is within desired limit. However, the pH value is increasing so it may be unfit for the future use. About 50% of Water samples containing chloride in excess of 250mg/l are considered undesirable for drinking purposes which may lead to cardiovascular diseases. The concentration of sulphate for each sample of villages is within desirable limit. Also it is found that 25% of samples containing total hardness more than 300 mg/l which is undesirable. In future there may be threat of decrease in groundwater quality. Public awareness must be created among the citizens about the importance of lakes/tanks and give awareness about importance of quality of Groundwater and surface water.

Keywords: Perennial, Physico-Chemical Characteristics, Monthly variation, Biological variations.

Seismic Analysis of Multistorey Diagrid Steel Structure With Different Diagrid Patterns

Supriya Mali *department of civil engineering, Rajarambapu Institute of Technology,* Sakharale, India. *Affiliated to Shivaji University, Kolhapur.* supriyamali74@gmail.com
2nd D. B. Kulkarni *department of civil engineering, Rajarambapu Institute of Technology,* Sakharale, India. *Affiliated to Shivaji University, Kolhapur.* dattatraya.kulkarni@ritindia.edu
3rd P. S. Patil *department of civil engineering, Rajarambapu Institute of Technology,*

Sakharale, India. *Affiliated to Shivaji University, Kolhapur.* pandurang.patil@ritindia.edu

Abstract—The improvement in the growth of the multistoried tall buildings is facilitated due to the advances made in structural systems, IS codes, various equipment, and investigative methods to verify, analyze and design the structure. In recent years the diagrid system has overcome the regular frames and the bracing systems because the diagrid structural system is comparatively very efficient and adaptable in architectural planning; also it modifies the aesthetic view of the building which is highly taken into consideration nowadays. The diagonal columns are arranged to set in particular collocation on the outer periphery of the structure to take the lateral load and gravity load, also it resists the seismic forces. The load carrying capacity of diagonal columns arranged in the particular patterns is more compared to regular vertical columns in a frame system. In this study, the seismic response spectrum analysis of 30 storied diagrid steel structures is done. The seismic response spectrum analysis is done for the building in seismic zone 3. The Indian standard code 800:2007 is used for the design of structural members. The modeling of steel structure having plan area 36mX36m is done in ETABS 2016 software. There are six structural models with different variable geometrical patterns. The building material and steel section properties are the same for all members of structural models. The comparison of seismic response spectrum analysis regarding displacement, story drift, story shears and bending moment is presented in this paper. The conclusions are made on the structural models with superior results for the same properties.

Keywords—multistory Steel structures, diagrid system, variable diagrid patterns, seismic analysis, ETABS 2016

A Study on specific gravity and plasticity characteristics of kaolinite-sand ,bentonite-sand mixtures

Jyothi D N Assistant Professor ,Department of Civil Engineering ATME College of Engineering Mysore , Karnataka jyothidevnaur@gmail.com
Dr.H S Prasanna Professor , Department of Civil Engineering The National Institute of Engineeirng Mysore, Karnataka hsprasanna62@gmail.com
Chethan Vishwanath Practicing Engineer Albina consultants Bangalore , Karnataka chethuvishwanath@gmail.com

Abstract— Index properties aid in identification classification, and assessment of behavior of fine grained soils. Index properties also have an influence on the shear strength, compaction, swelling, bearing capacity and shrinkage characteristics of the fine grained soil.
This paper deals with the assessment of index properties of artificially prepared fine grained soil mixtures (Kaolinite-Sand Mixtures and Bentonite-Sand Mixtures of varying proportions). An attempt to correlate the index properties with natural soil has been made in this study. The studies showed that Atterberg limits of the soil under study can be correlated (with respective clay size) linearly with fair degree of accuracy. These correlations are helpful in predicting the index properties of soils.
Keywords— Grain size distribution, Liquid limit, Plastic Limit, shrinkage Limit .

Parametric study of a precast pre-stressed tall structure subjected to zone III seismic effects

Aptha M. Hegde PG scholar
Department of civil Engeneering Manipal Institute of technology Manipal
apthahegde@gmail.com
Arjun V. Mudambi Director TRC Engineering (l) Pvt. Ltd. Bangalore arjun@trcintl.com
Prof. Ravindranatha Assistant professor
Department of civil engineering Manipal Institute of technology
Manipal ravi.nath@manipal.edu

Abstract— Precast construction is an advanced technology that is being adopted in India in recent times due to its advantage of rapid construction. As the precast components are cast separately, to make structure behave monolithically is a challenge. Tall structures are solution for highly populated countries which has shortage of land. These buildings are to be designed efficiently to carry gravity loads, and to resist wind and seismic forces and to protect the occupants from fire. If the lateral loads are neglected, catastrophic failure occurs. Hence lateral force resisting system plays an important role. The main target of this paper is to study the response of precast pre-stressed tall structure that is located in seismic Zone III and wind zone II with (a) Shear wall (b) Frame and (c) Dual System. Analysis is done by applying wind and seismic loads according to IS codes of practice using existing finite element tool ETABS v16. G+10, G+15 and G+20 storeys with soil type I are taken into consideration. Effects of lateral load resisting system vary with height of building. In this study story drift, deflections, base shear and time period of the structure under consideration were evaluated.
Keywords— Precast, Tall structure, Lateral load resisting system, ETABS

Introduction of project management systems in the construction of M K Apartments

1Monish Kumar K Construction Technology and Management JSSS&TU Mysuru,India
monish209@gmail.com
2Dr.P.S Raghuprasad Construction Technology andManagement JSSS&TU Mysuru,India
psrsjce@gmail.com
3Dimple.B Construction Technology andManagement JSSS&TU Mysuru,India
4Pallavi K.B Construction Technology andManagement JSSS&TU Mysuru,India
kpallavi473@gmail.com

Abstract—Microsoft Project 2013 is used as a project management tool for the purpose of scheduling the various activities involved in the project and produce a cost estimate for labour and material used for the project, check lists are introduced for various activities involved in the project in order to monitor the quality of the project.

Keywords— Microsoft Project 2013, scheduling, project, activities, labour, material, check lists

Effect of Styrene Butadiene Rubber (SBR) Latex on Compressive strength of High Performance of Concrete made with Artificial Sand

Shabnam Mujawar and Vidya Patil

ABSTRACT -The difference between ordinary concrete and HPC is basically the use of chemical and mineral admixtures. Effect of styrene -butadiene Rubber (SBR) latex on compressive strength and flexural strength of concrete has been studied and also the optimum polymer content for concrete is calculated. This research was carried out to establish the effect of polymer addition on compressive and flexural strength using concrete with mix design of constant water-cement ratio. The mixes ere prepared with styrene-Butadiene Rubber latex cement ratio of 0%, 3%, 5%. In addition of SBR latex in concrete results in enhancement of Compressive strength and Flexural Strength. The dosage of SBR latex needs to be adjusted to maintain required workability of concrete.

KEY WORDS: High performance concrete, Styrene Butadiene Rubber (SBR), Compressive Strength.

Waste Water Treatment and Generation of

Electricity Using Microbial Fuel Cells

Arya Sajith, Akash A Menon, Jawahar Saud S, Indeevar Krishna Ashok,

Department of civil engineering, Federal Institute Of Science and

Technology (FISAT) Ernakulam, India

Email: aryasajith@gmail.com

Abstract— Renewable energy will one day be a large portion ofglobal energy production and usage. Microbial fuel cell technology represents a new form of renewable energy by generating electricity from what would otherwise be considered as waste. According to this technology it uses the bacterium already present in wastewater as catalysts for generating electricity by converting organic matter into electricity while simultaneously treating wastewater. Our objective in this study is to create a double chambered MFC by using a clay ware mixed with 20 % montmorollonite as the proton exchange membrane and graphite felt as the electrodes and to compare the COD and PH value of the waste water before and after the experiment to know the extent of waste water treatment. The main attraction of such a setup is that the by product formed after the chemical reaction is no chemical but pure water. MFC technology represents a unique and novel platform to process waste and wastewater sources that allows for energy and resource recovery along with water sanitation in a single configuration.

Keywords—Microbial fuel cells, waste water treatment,

energy production.

Green algae and activated carbon as low cost adsorbents for nitrate removal from groundwater

Hredya E M Dept. of Civil Engineering Federal Institute of Science And Technologyame of organization Ernakulam, India hredya128@gmail.com

Jayakrishnan V S Dept. of Civil Engineering Federal Institute of Science And Technologyame of organization Ernakulam, India jayakrishari997@gmail.com

Afnitha Abdul Samad Dept. of Civil Engineering Federal Institute of Science And Technologyame of organization Ernakulam, India afnithachinnu@gmail.com

Jawahar Saud S (Asst. Professor) Dept. of Civil Engineering Federal Institute of Science And Technologyame of organization Ernakulam, India jawahar405@gmail.com

Aditya Gopal Dept. of Civil Engineering Federal Institute of Science And Technologyame of organization Ernakulam, India adithyagpl009@gmail.com

Abstract— Nitrogen is present in atmosphere and is essential for all living things. However excess nitrate-nitrogen present in water can lead to adverse effects on living beings. In some places, the concentration is more than USEPA standards of 10mg/L nitrate-nitrogen (45mg/l nitrate according to Bureau of Indian Standards) and was mostly due to presence of wastewater disposal sites, landfills and septic/solid disposals. Elevated concentrations of nitrate in surface and ground waters can cause eutrophication of natural water bodies, and in drinking water they can pose a threat to human health, especially to infants by causing 'blue baby' syndrome. Various treatments have been found for removing ground nitrate from groundwater. Adsorption technology is an attractive method to remove nitrate from water compared to other technologies in terms of simplicity, cost, design, operation and maintenance, and effectiveness. The use of low cost adsorbents like green algae and activated charcoal has been investigated as a replacement for the current expensive method of removing nitrate. The main objective in this work is to investigate and implement a conceptual layout for an inexpensive and simple system focused on column based study that would treat the ground water such that the nitrate content is reduced to a great extend and brought down to the permissible drinking water standards so that it can safely be used for drinking purposes.

Keywords—nitrate concentration, adsorption, green algae, activated carbon, flow rate, thickness of layers

A study on influence of GGBFS as binder on bond strength behavior of Reinforced concrete

Prashanth V P,

CT&M Department

SJCE, JSSSTU

Mysuru, India

prashu.cvl@gmail.com

Mahendra Kumar H M

Civil Engineering Dept.

SJCE, JSSSTU

Mysuru, India

manuhm33@gmail.com

Dr.G.P.Chandradhra Civil Engineering Dept.

SJCE, JSSSTU

Mysuru, India

chandu_gpc@yahoo.com

Abstract:-The performance of Reinforced concrete is primarily depends on the bond strength, is defined as resistance to slipping of the reinforcing steel bars from the concrete. This slipping resistance is predominate mode of failure in the predicting the mechanical performance of RCC, particularly to its failure mode and adhesion between steel reinforcement and concrete. An attempt is made to study the bond strength of structural grade concrete (M35) with high strength steel of 12 mm,14mm and 16mm (Fe500) embedded in the core of concrete. The pull out test was carried out to for various mixes of concrete with a addition of GGFS as partial replacement with cement (10% to 30%). Also, attempt was made to evaluate the resistance for slippage, rupture behaviour and stress distribution for various diameters by using finite element analysis tool. The bond strength improves the consideration of mineral admixture and also seems to improve with diameter of reinforcing bars for GGFS binder based concrete. The microstructure (SEM) is also evident for the minimal voids and densification with addition of GGFS as binder, which enhance the bond strength with a partial replacement of cement.

Keywords - Bond strength, pullout test., Steel concrete interphase, GGBFS, Microstructure.

BAGASSE ASH AND QUARRY DUST AS EFFECTIVE REPLACEMENT IN FLY ASH BRICKS

JYOTI. PATIL. CIVIL ENGINEERING DEPARTMENT S.G.BALEKUNDRI INSTITUTE OF TECHNOLOGY, BELAGAVI, INDIA jyoti.patil91@gmail.com

RAJEEV. LAKKANNAVAR. CIVIL ENGINEERING DEPARTMENT S.G.BALEKUNDRI INSTITUTE OF TECHNOLOGY, BELAGAVI, INDIA RajeevLakkannavar@gmail.com

APPANNA. MASARADDI. CIVIL ENGINEERING DEPARTMENT S.G.BALEKUNDRI INSTITUTE OF TECHNOLOGY, BELAGAVI, INDIA appannamasaraddi96@gmail.com

Abstract— Bagasse ash is a by-product of the sugar industry. The disposal of this material in an open land is causing environmental problems. This bagasse ash has a high content of silica and possesses pozzolanic properties. Hence it can be used in partial replacement of fly ash by bagasse ash. Fly ash also being a byproduct of thermal power station, its utilization is becoming more compared to its generation. In the study, the fine aggregate (Sand) is completely replaced by quarry dust which also is the byproduct of stone quarries. The aim of this research work is to make green,eco-friendly and economical bricks,which reduce pollution and avoid problem of ash disposal.Trial bricks of dimensions 230 x 100x 70 mm are manufactured with different proportions(0 %, 10 %, 20%, 30%, 40 %, 50%) by replacing fly ash with bagasse ash. Quarry dust is used as a fine aggregate in the study. After experimental investigation, the maximum compressive strength is obtained at 20 % replacement of fly ash by bagasse ash.

Keywords— Fly ash (Class F), Bagasse ash , cost feasibility, Eco friendly bricks

STUDY ON DURABILITY ASPECTS OF SELF COMPACTING MORTAR

SUBJECTED TO ACID AND SULPHATE ATTACK

Rashmi R.Ghali*

*Assistant Professor, Faculty Department of Civil Engineering, JSSATE, Banglore.

ABSTRACT

Mortar serves as one of the basis for workability properties of SCC and these properties could be assessed by Self-Compacting Mortar (SCM). In fact, assessing the properties of SCM is an integral part of SCC design. As a new technology product, SCMs are especially preferred for the rehabilitation and repair of reinforced concrete structures. The repair mortar applied to concrete is usually hard to consolidate, and in most cases vibration is not possible. From this point of view, the self compactability of repair mortars may bring consolidate advantages at narrow mould systems such as coating. With the development of new generation plasticizers, it is possible to obtain high filling rates even for complex mould systems.

The present experimental investigation aims to study the durability of SCM with partial replacement of cement by 40% Fly ash and 40% Ground granulated blast furnace slag (GGBFS) powder separately and also replacing the cement by the combination of 20% Fly ash & 20% GGBFS and also replacing cement by combination of 30% Fly ash & 10% GGBFS and 10% Fly ash & 30% GGBFS which amounts to 40% replacement of cement and comparing the properties like compressive strength, flexural strength and difference in weight gain or loss for 7, 28 & 90 days with respect to control SCM before and after immersing the specimen into acid and alkali media. Conclusions are drawn based on the experimental results.

Keywords: Self-Compacting Mortar (SCM), Fly ash, GGBFS, self-compactibility, Compressive Strength, Flexural Strength.

Seismic Structural Appraisal for Typical Structural Systems in High Rise Buildings Including P-Delta Effects

Vidya Chatradamath Dr.C.M.Ravi Kumar

Asst Professor, dept. of civil engineering, Asst Professor, dept. of studies in civil engineering,

S T J Institute of Technology, University B.D.T College of Engg,

Ranebennur, India Davangere, India

vidyamc.100@gmail.com cmravibdt@gmail.com

Abstract — As urbanization increases universal the available land for building is become scarcer and cost of the land becomes higher. Popularity of high rise structure of rigid joint frame systems is increasing day by day to accommodate growing people in metropolitan city. A tall structure should be designed to resist the lateral load like earthquake forces with in the permissible limits set by standards. The process is outlined and evaluated for the estimation of seismic response of high rise reinforced concrete building with different structural systems including P-Delta effect. Linear static analysis can be performed for low rise structure and less earthquake prone areas only. In case of tall buildings it is necessary to consider the nonlinearity, which is generally observed in geometry and materials. In the present study geometric nonlinearity is considered for the analysis. The present study focuses on the seismic analysis of G+30 storey reinforced concrete building with different structural systems. Ten cases and two different analysis are performed evaluate the effectiveness of different structural systems and effect of P-Delta on high rise buildings using ETABS structural analysis software. From the analysis displacement and storey drift with respect to earthquake loads are less compare to P-Delta analysis.

Performance Evaluation of Deep beams using Self-compacting concrete subjected to corrosion

MANJUNATH R1, MATTUR C. NARASIMHAN 2, BIBESH NAMBIAR C 3

Research Scholar1, Professor2, Graduate Student3

Dept. of Civil Engineering, National Institute of Technology Karnataka, Surathkal Mangalore, India.

rmanju301@gmail.com,mattur.cn@gmail.com

Abstract — Effect of corrosion on RCC - SCC deep beams subjected to three different percentages of corrosion have been investigated in the present study. These SCC mixes were designed for obtaining a cube strength of M-30 grade using river sand as finer portions of the aggregate and 12.5mm downsize jelly as coarse aggregate. Design of SCC reinforced concrete deep beams were carried out as per IS-456:2000 and the accelerated corrosion technique have been employed for carrying out the corrosion. All the trial SCC mixes were subjected to different flow ability tests in order to evaluate their SCC property as per the EFNARC guidelines. From the obtained test results it can be observed that for the lower percentage of corrosion decrease in ultimate flexural strength was observed due to decrease in arch action. Further with increase in percentage of corrosion showed an increased ultimate flexural strength due to increase in arch action.

Keywords— Deep beams, Self-compacting concrete, Corrosion, Faradays Law, Ultimate flexural Strength.

Performance Evaluation of Steel Fiber reinforced Deep beams using Self-compacting concrete

MANJUNATH R1, MATTUR C. NARASIMHAN 2, JANAGAM 3

Research Scholar1, Professor2, Graduate Student3

Dept. of Civil Engineering, National Institute of Technology Karnataka, Surathkal Mangalore, India.

rmanju301@gmail.com,mattur.cn@gmail.com

Abstract — Reinforced self-compacting deep beams was developed and their performance with varying percentages of steel fibers have been investigated in the present research. Fine aggregate being river sand along with 12.5mm downsize jelly as coarse aggregate and all the concrete mixes were proportioned for attaining a strength of M-30 grade concrete. Based on standard code IS: 456-2000 all the reinforced SCC deep beams were designed. As per the EFNARC guidelines all the SCC mixes were subjected different flow ability tests for ascertaining the concrete as SCC mixes. Test results concluded that the ultimate flexural strength of the reinforced concrete deep beams increased with the increase in the percentage of steel fibers due to the better stitching actions of the steel fibers with the cementitous matrix.

Keywords— Reinforced Deep beams, Self-compacting concrete, Steel fibers, Ultimate flexural Strength.

Overview of mechanism of recent trends in bracing system

Mane N. P. department of civil engineering, Rajarambapu Institute of Technology, Sakharale, INDIA. Affiliated to Shivaji University, Kolhapur. nikitamane7701@gmail.com

2nd Patil. P. S department of civil engineering, Rajarambapu Institute of Technology, Sakharale, INDIA. Affiliated to Shivaji University, Kolhapur. pandurang.patil@ritindia.edu

3rd Desai. P. D. engineer and structural consultant, De facto engineers and associates, Kolhapur, INDIA. desaipiyush1287@gmail.com

Abstract— In this paper a review is carried out on different bracing systems such as O Grid bracing system, braced ductile shear panel (BDSP), buckling restrained bracing (BRB) and bracing with the different mid connection. A conventional bracing system has certain limitations which limit the deformation ductility capacity. Conventional bracing has limited deformation ductility capacity, as a result, it imparts certain limitations over total lateral load carrying capacity of the structure. Many of problems with conventional bracing such as less energy dissipation, buckling of bracing, less energy absorption and large lateral deformation of the structure, etc. have studied. This paper briefs about review of the mechanism of different bracing systems. With the use of innovative bracing systems such as O Grid bracing system, braced ductile shear panel (BDSP), buckling restrained bracing (BRB) and bracing with different mid connection ductility, load carrying capacity, lateral load resisting capacity increases.

Keywords—bracing system, deformation, buckling of bracing, ductility.

Effect of diaphragm discontinuity on the seismic response of an RC building

Vincle Mable Vas Civil Engineering Department NITK, Surathkal Mangalore, India
vas.vincle@gmail.com

Prajwal Nagaraja Civil Engineering Department NITK, Surathkal Mangalore, India
prajwalnagaraj143@gmail.com

Katta Venkataramana Civil Engineering Department NITK, Surathkal Mangalore, India
ven.nitk@gmail.com

Abstract— Although rigid floor diaphragm is a reasonable assumption for seismic analysis, certain building configurations may exhibit diaphragm flexibility. Detailed investigations have been carried out on modelling of flexible diaphragms compliant with various codes such as ASCE-07 and UBC 1997. Studies have shown that diaphragm flexibility amplifies both the deformation and the shear in the diaphragm. However, additional studies are essential to assess the magnitude of such amplification and to account for it in the design. The methodology is outlined by three major elements such as the choice of building models, the adopted method of analysis and the parameters studied. Buildings with large cut-outs and openings are observed to exhibit flexible behavior. These models are analyzed dynamically using a site-specific response spectrum developed from probabilistic seismic hazard analysis (PSHA) for Mangalore region (a coastal city in Karnataka, Southern India). The analysis is carried out using a G+10 RC building. The effect of percentage of openings in the diaphragm is studied using structural parameters such as storey drift, base shear and storey displacement with the help of ETABS 2015 software and the optimum shape for these openings in a building plan is finalized. Further, time history analysis is performed over the models and the results obtained through response spectrum and time history analysis are compared. The study highlights the importance of diaphragm flexibility in determining the seismic response of a building. This flexibility causes significant increase in the building period, which results in reduction in the earthquake-induced base shear. Since the seismic input used for the study was developed for the moderate seismic zone, the outcomes of this investigation are believed to have vast applications.

Keywords— Response Spectrum, Probability seismic hazard analysis, Building period, Base shear, Time history analysis

STASTISTICAL FIELD BASED COMPUTATION OF HEADWAY ON AN INTERSECTION

Sachin Rangannavar Civil Department PES University Bangalore, India

Rangannavarsachin@gmail.com

Gangaraja C S Civil Department PES University Bangalore,

gangarajacs@gmail.com

Sourabh Byakod Civil Department PES University Bangalore,

Sourabhbyakod1@gmail.com

J S Vishwas

Assistant Professor Civil Department PES University Bangalore,

vishwajs@pes.edu

Abstract—Traffic signal planning for new installations involves the estimation of saturation headway for green time allocation to optimize intersection throughout. the Highway Capacity Manual (HCM) procedure is usually adopted in estimating values. The HCM requires the estimation of a base saturation flow rate at studying intersection. Intersection planning analyses require reasonable approximations to actual saturation flows reflecting local conditions. This paper analyses saturation headway data obtained from intersection in Bengaluru. The study compares the base saturation headway of 1.9s recommended in HCM with the saturation headways observed from computation. A student t-test concludes that there exists a statistically significant difference between the saturation headways observed and HCM recommended value. This is necessary to allay the assumption of homogeneity of the application of HCM base flow rates and highlights the need for alternative saturation flow estimates. Statistical computation of headway has significant impact in computation, analysis and design of cycle signal for an intersection. Usually capacity of a lane is maximum flow Which can be calculated using headway also. As years passes by the number of vehicles will be more so in order to provide comfort and efficient transportation.

Keywords—Capacity, Speed, Flow, Signal timing, Traffic analysis, Saturation Headway.

Monitoring Land Use and Land Cover Changes in Coastal Karnataka

Satish Kumar Mundlamuri Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India satishmundlamuri@gmail.com

Venkatesh Kolluru Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India venkateshkolluru95@gmail.com

S B Gowthami Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India siranagowthami@gmail.com

Anjita N.A Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India anjitaneelatt@gmail.com

Nayana N Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India nayananarayanan627@gmail.com

Linda Regi Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India linda.regi.1994@gmail.com

G.S Dwarakish Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India dwaraki.gs@gmail.com

Abstract— The dynamics of land use/ land cover can be studied by using digital change detection techniques which are highly significant for the evaluation and development of management strategies in a region. The environmental and hydrological processes prevailing in the area can be interpreted only by analyzing the alterations in past and present land use land cover classes. In view of this, the present study is executed to analyze the typical land use change in the coastal region over the three decades by analyzing historical and current LU/LC (Land Use Land Cover) datasets. Landsat 5 and Landsat 8 satellite datasets were considered for change detection analysis using unsupervised classification method. K-means algorithm, a widely used unsupervised classification technique was adopted in this study to classify coastal region of Karnataka for the years 1990 and 2019. The level-ii classification was performed on LU/LC raster datasets (Landsat 5 and 8) which segregated the entire study area into ten classes namely agricultural land, barren land, built-up area, water, forest, fallow or cultivated land, scrub forest, sandy area, swampy forest and wetlands. This study encapsulated that, about 40% of the study area was occupied by water body followed by forestry with a percentage of around 30%. Major changes were observed in the barren land and scrub forest between 1990 and 2019, where the barren land was replaced by scrub forest in 2019. The accuracy assessment is performed to analyze the efficiency of the algorithm and the precision of the classified image which showed an accuracy of 81% in 1990 and 84% in 2019 demonstrating the ability of an algorithm to classify reliably.

Keywords— LU/LC Classification, Change Detection, K-Means Algorithm,

STUDIES ON COMBINED FLY ASH AND GGBS BASED ALKALI ACTIVATED CONCRETE MIXES WITH WASTE IRON CHIPS AS PARTIAL REPLACEMENT TO FINE AGGREGATES

Divakar L Assistant Professor Dr. Santhosh M. Malkapur Assistant Professor

Manoj Kumar B V Post Graduate Student Department of Civil Engineering Ramaiah University of Applied Sciences, Bangalore-560 054

Contact Author E-mail: divakarl.ce.et@msruas.ac.in

ABSTRACT: Alkali activated concrete is essentially cement free concrete resulting from the reaction of a source material that is rich in silica and alumina with an alkaline liquid. This material is being studied extensively and is a promising green substitute for ordinary Portland cement. In the present study, the waste iron chips obtained as industrial scrap are used as partial replacement to fine aggregates in the alkali activated concrete. The behaviour of alkali activated concrete mixes with waste iron chips in terms of strength and durability properties are evaluated. It is observed that, all the mixes with the waste iron chips have shown better strength characteristics compared to the reference mix. However, waste iron chips at 20% replacement had the better strength characteristics among all the mixes. For acid attack, slight decrease in mass and strength was observed and for sulphate attack no significance change in mass and strength after exposure are observed.

Key words: Alkali activated concrete, Durability, XRD, Waste Iron Chips.

PERFORMANCE OF MORTARS WITH PARTIALLY REPLACED IRON SLAG AS FINE AGGREGATE – A SUITABLE ALTERNATIVE

Arpitha D Dept. of Civil Engg. N.I.T.K.,Surathkal, Karnataka arpitha.5790@gmail.com C. Rajasekaran Dept. of Civil Engg. N.I.T.K.,Surathkal, Karnataka bcrajasekaran@nitk.edu.in Sudarshan V J Dept. of Civil Engg. N.I.T.K.,Surathkal, Karnataka joresudarshan@gmail.com Nagesh Puttaswamy Ultratech Cement Ltd Bengaluru, Karnataka nagesh@nageshp.com Thilak Kumar Y T Dept. of Civil Engg. N.I.T.K.,Surathkal, Karnataka thilak8741@gmail.com Panditharadhya B J Dept. of Civil Engg. N.I.T.K.,Surathkal, Karnataka pandith23@gmail.com

Abstract:- Due to extreme urbanization and industrialization there is increase in the construction, for which the sector is facing greater challenges to serve the squeezing needs of human culture specifically the protection of nature and to meet the infrastructure prerequisites of increasing population. The cement and concrete industries are now slowly becoming aware of the environment and sustainable development issues. Currently sand mining has disastrous environmental impact and this extensive mining of river bed is creating an ecological imbalance which has led to impose ban on mining subsequently escalating its cost by several manifolds, thereby increasing cost of construction. On the other hand, industrial wastes are creating environmental problems, the safe disposal of which is a hurdle leading to find an appropriate measure to mitigate this, some of the waste has potential to be used in the construction sector. These metallic slags can be found its advantages affiliation to sea water and marine constructions. To make sea erosion breakers, jetty piers, retaining walls and other structures exposed to sea water more durable around the shore, concrete is used in some places as a slow sacrificial material. An approach has been made to evaluate the effects of utilization of iron slag as an alternative for fine aggregates in mortars. Also, focused to understand the compatibility issues and interaction between different combinations of mortar by partially incorporating fine aggregates with slag. The fluidizing effect of the admixture on mortar in the presence of mineral additions is studied based on the flow behaviour and compressive strength of mortar. Rheological properties of mortar help to identify the desirable combinations and thus to carry out further investigations to understand the hardened properties of mortars. Keywords— mortars, superplasticizers, Ordinary Portland Cement, Portland Pozzolana Cement, compatibility, rheology.

A Study on Risk Assessment and Mitigation Techniques for City Surveillance Projects

Dikshant Jeswani Dept. of Civil Engg. National Institute of Technology Surathkal, Mangalore, India jeswanidikshant@yahoo.co.in

C. Rajasekaran Dept. of Civil Engg. National Institute of Technology Surathkal, Mangalore, India bcrajasekaran@gmail.com

Kiran Kumar HM Smart World & Communication IC L&T Construction Chennai, India

Abstract— The Indian government is planning to have 100 Smart Cities by the end of 2022. While the urban communities have been identified and work has started in most of them, there are a lot of underlying aspects that need to be addressed. One of them, as per the Smart Cities Council of India, is the need for the growth of video surveillance security and development of surveillance standards. Being the first of its kind in India, City Surveillance projects are one of the most challenging, highly dynamic and risky projects as they are of national importance. The main aim of this study is to identify all the critical risk factors in city surveillance project. The RIPC4 model is developed using risk factors as input and project cost variation and schedule variation as output. This model enables to predict the likely changes to estimated total cost and planned duration of the project.

Keywords — Smart Cities, City Surveillance, Risk management, RIPC4 model

Contribution of Slab Type on Structural Systems in Multistoried R.C.C. Building

Nandkumar S. Bane Research scholar, Department of civil engineering, Ashta, India nandkumarsbane@gmail.com Kiran K. Shinde Assistant professor, Department of civil engineering, Annasaheb dange college of engineering & tecvhnology, Ashta, India kkk_civil@adcet.in

Abstract— paper contain design of G+20 story building to mainly lateral loads (wind load and earthquake load). Slab is structural part of building which transfer loads to beam or respective structural component. In this paper contribution of slab taking as thick shell, thin shell and membrane in load distribution against lateral load is checked. For this E-Tabs software is used.

Keywords—slab, thick shell, thin shell, membrane, G+20, ETabs.

Siltation and tranquillity studies for NMPT breakwater using DELFT3D

Therese Kurian* Department of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India theresekurian@gmail.com Dr. Manu** Department of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, India manunitk77@gmail.com

Abstract— Siltation is the increased concentration of suspended sediments and its accumulation on the bed. It is one of the major problems faced by most of the ports and harbours. Due to the action of waves and currents large amount of sediments move in the near shore zone and causes siltation problem at breakwater mouth and navigation channels. Planning of ports and harbours depends on the coastal hydrodynamics and the wave hydrodynamics. The coastal hydrodynamics includes the flow fields due to tides and waves, where the tidal hydrodynamics are well predicted along the coastline. On the other hand, the wave hydrodynamics deals with propagation and deformation of waves as they travel from deep ocean to near shore region. Physical and environmental conditions and the geometric configuration of the port entrance also governs the quantity of siltation. A numerical model Delft 3D is used as a tool for estimating the amount of siltation on an existing port entrance as well as to check the tranquillity of the port for the given study area. The Accretion/Erosion taking place on the existing breakwaters and the amount of siltation are estimated. The wave data used consists of the data of NMPT from INCOIS. A part of bathymetry data is collected online from GEBCO and the remaining bathymetry data is taken through Delft Dashboard. The Astronomical constituents used for tidal boundary conditions are taken from Delft Dashboard. The model validation against Accretion and Erosion, identified siltation and tranquillity can be carried out based on the past studies done on NMPT and from satellite imageries of the area. Keywords— Siltation, Tranquillity, Breakwater, Numerical modelling, Delft3D

Structural Auditing of residential building

Gourav Sanjay Shinde Dept. of civil engineering Annasaheb dange college Of engineering Ashta, India gouravshinde94@gmail.com Asst.Prof. Vidya M Patil Dept. of civil engineering Annasaheb dange college Of engineering Ashta, India vmp_civil@adcet.in Dr S.J.Arwikar Dept. of civil engineering Annasaheb dange college Of engineering Ashta, India

Abstract— This paper covers the study of Structural Auditing of Residential Building. Now a days structural AudViting is necessary because of the poor quality of construction, carelessness in supervision during construction, use of poor quality of materials, carelessness by labors during work because of such reasons the quality of the building goes down and then automatically life of the building goes down. Now a days life of the building comes 60 years from 100 years because of such reasons we need to do Structural Auditing of the building after 15 years to check whether it is safe or not if not then remedial measures to be provided. Now while performing the audit of a residential building and we have conducted nondestructive testing on this building like Rebound hammer and ultrasonic Pulse velocity meter test after getting test results we have decided the building is safe or not and if it is not safe then remedial measures will be provided to increase the life of the building.

Keywords— Structural Audit, NDT Methods, Structural Engineering, Rehabilitation. Building inspection, repairs and control I

STUDY ON THE EFFECT OF HETEROGENEOUS TRAFFIC ON LEVEL OF SERVICE AT A SELECTED INTERSECTION

Bhavadeep K Civil Department PES University Bangalore, India kalikiri22@gmail.com
Dhanush H R Civil Department PES University Bangalore, hrdhanush007@gmail.com
Nimith N Civil Department PES University Bangalore, nimithnimmu@gmail.com Guided by: J S Vishwas Assistant Professor Civil Department PES University Bangalore, vishwajs@pes.edu

Abstract—The classification level of service with regard to Indian roads for heterogeneous vehicular flow is highly complex. The existing study is a categorization of level of service at a selected 3 legged rotary intersection located in the metropolitan city of Bengaluru i.e, at the junction located near Orion Mall. Traffic surveys are executed at the site to comprehend the flow characteristics of heterogeneous traffic. Considering the versatile factors such as volume, capacity and operational characteristics we quantify the heterogeneous flow into 6 different levels of service. The selected 3 legged rotary junction was Mysore sandal soap factory junction located in the heart of the city which comprises of three major roads WEST OF CHORD , Dr. RAJKUMAR and TUMKUR. Turning movement count, speed studies, queue length, road inventory survey was carried out at the junction. The gathered data were used to assess the level of service (LOS) at the junction. Based on our study the various differences and relations between the functional parameters are addressed. The quantification of level of service (LOS) was concluded at the junction and based on this necessary suggestion are given in order to improve the flow of traffic and also the level of service (LOS).

Keywords—Heterogeneous, Capacity,Speed, Flow Characteristics, Level of Service (LOS), Turning Movement Count(TMC)

Sustainable design of speed breaker for production of electricity using piezoelectric materials

JS Vishwas1 , Mohammed Maseeh Ibrahim2 , Rishikesh Raman3 , K Deepak4 Assistant Professor1 , Student2, 3, 4 Department Of Civil Engineering PES University Bangalore, India 1vishwajs@pes.edu, 2mmaseehi@gmail.com, 3hrishikeshraman16@gmail.com, 4kolladeepak38@gmail.com

Abstract- Energy is a very essential element of our everyday lives. With the increasing dependency of humans on machines the energy requirements are also on the rise. This coupled with increase in population has created a massive demand for energy. The majority of this demand is generated by the fossil fuels and other conventional sources of energy. Due to this the resources are being depleted at a very high rate. Also the high use of fossil fuels has been contributing to the pollution which has led to the adverse effects caused due to global climate change. The shift to Non-conventional energy sources is occurring at a slow rate and this can be changed by increasing the applications of nonconventional sources in the real world. This research project shows the possibility of harnessing the wasted kinetic energy of moving vehicles. This kinetic energy is converted to mechanical energy using speed breaker which is finally converted to electrical energy using piezoelectric materials. This clean energy can be used to recharge batteries, lighting the streets or to power traffic lights. Less dependence on fossil fuels and shifting to renewable energy sources is the only way for sustainable development and high quality of life.

Keywords:- Energy, Climate change, Non-conventional energy source, Speed breaker, Piezoelectric materials, Sustainability

Performance characteristics of SCC concrete mixes with waste iron chips as partial replacement to fine aggregate

*Santhosh M. Malkapur1 , Naveen Kumar H. S. 2 , Pramod J3

2Assistant Professor, Department of Civil Engineering, Ramaiah University of Applied Sciences, Bangalore-560 054

1 Assistant Professor, Department of Civil Engineering, Ramaiah University of Applied Sciences, Bangalore-560 054

3Post Graduate Student, Ramaiah University of Applied Sciences, Bangalore-560 054
*Contact Author E-mail: sm.malkapur@gmail.com

Abstract: In a developing country like India construction activity is growing rapidly every year needing large amounts of construction materials. Such a huge demand creates a scarcity of building materials. Demand for natural river sand all over India is very high and there is a need to fulfil the demand of natural sand. One alternative is to partially replace sand with industrial waste products such as waste iron chips. The aim of this paper is to study the effect of waste iron chips as a partial replacement of fine aggregate in SCC. Waste iron chips are replaced in varying percentages of 10-50% for fine aggregate. The results show that the workability of SCC decreases with increase in iron chips. Compressive strength and split tensile strength increase up to 20% replacement of waste iron chips later it gradually decreases for the waste iron chips considered. Durability tests like acid attack and sulphate attack tests were conducted. Significant decreases in the strengths of the mixes are observed for acid attack and no significant changes in the strengths are seen after the sulphate attack.

Key words: SCC, Waste iron chips, SIC mixes, Strength, Durability

An Experimental Investigation on Toe Stability for Vertical - Caisson Breakwaters

Kumaran V. Applied Mechanics and Hydraulics NITK, Mangalore, INDIA
vkumaranms@gmail.com

B.Vinay kumar Applied Mechanics and Hydraulics NITK, Mangalore, INDIA
bvinay180@gmail.com K.Sadhik Applied Mechanics and Hydraulics NITK, Mangalore, INDIA sadhikcivil@gmail.com

Subba Rao Applied Mechanics and Hydraulics NITK Mangalore, INDIA
surakrec@gmail.com Manu Applied Mechanics and Hydraulics NITK Mangalore, INDIA
manunitk77@gmail.com

Abstract— For the design & construction of a vertical-caisson breakwater (VCB), which is an more important task in the field of Ocean engineering subject, since the first wave & reflected wave acting on the VCB, causes severe bottom scouring and final leads to failure of the structure. To overcome this problem, and to check the toe armor unit stability and its cross section, needed for the toe protection of the vertical-caisson breakwater (VCB). As per Coastal Engineering manual, the experimental work conducted by Brebner and Donnelly (1962), adequate the empirical formula for the design of toe armor for the fixed foundation depth of fixed d1/d (relative foundation). A preliminary investigation is conducted at the regular 2D wave flume of Department of Applied Mechanics and Hydraulics, NITK, Surathkal. The present paper provides the required information regarding the damage level of armor units in transition water depths and the effect of wave parameters are analyzed. Based on the preliminary experimental results the stability of the toe are arrived for a certain fixed d1/d (relative foundation).

CONSUMPTION OF ION EXCHANGE RESIN WASTE IN CONCRETE

R.Vijayakumar1 , Dasarathy. A K.2*, M.Tamil Selvi3 and S.PonkumarIlango4 1Asst Professor ,Department of Civil Engineering, Veltech Multitech

Dr. Rangarajan Dr. Sakunthala engineering college, Avadi, Chennai 600062, India 2* Professor, Department of Civil Engineering, Veltech Multitech

Dr Rangarajan Dr Sakunthala engineering college, Avadi, Chennai 600062, India. ,*Corresponding Author, 3 Professor, Department of Civil Engineering, Veltech Hitech

Dr Rangarajan Dr Sakunthala engineering college, Avadi, Chennai 600062, India. 3 Assistant Professor, Department of Civil Engineering,

Dr. M.G.R. Educational and Research Institute University Chennai 600095, India

E.Mail 1 rdkvijay@gmail.com, 2pulikutty2000@yahoo.co.in, 3 tamilselvi_05@yhoo.com 4 sp.ilango@yahoo.co.in Ph 18610397029, 29840062899 , 39840123624 and 49791116736

ABSTRACT This project deals with the investigation of strength property of concrete made by partial replacement of cement using ion exchange resin waste. Ion exchange resin waste is readily available at free of cost in various industries. We are using the cation exchange resin waste from water softening process. This waste material is collected from a local place in Chennai In recent years, ion exchange resin is used in concrete for corrosion resistant purpose. The percentage replacements of cement by using ion exchange resin waste are 10%, 20% and 30% by weight. The results indicate The selected concrete grade is M30 and water cement ratio is 0.45. Cubes and cylinders are casted with the specified replacement of cement by using ion exchange resin waste. The strength has been checked at 7 days, 14 days and 28 days curing for the specimens made with specified partial replacement of cement by using ion exchange resin waste. Cubes are subjected to compressive strength test and cylinders are subjected to split tensile strength test. It has been concluded that the reasonable strength of 31.76 N/mm2 (Target strength of M20 grade concrete) may be attained in M30 grade mix ratio while adding ion exchange resin waste as 10% replacement of cement. So the optimum percentage of replacement of cement is 10% for both cubes and cylinders.

Key words: Concrete, ION resin, Split tensile strength ,Compressive strength

Power And Selves Of Steel Fibre Reinforced Self Curing Concrete

R.Nandhakumar1 , M.Tamil Selvi.2*, Dasarathy. A K 3 and S.PonkumarIlango4 1Asst Professor ,Department of Civil Engineering, Veltech Multitech

Dr. Rangarajan Dr. Sakunthala engineering college, Avadi, Chennai 600062, India 3 * Professor, Department of Civil Engineering, Veltech Multitech

Dr Rangarajan Dr Sakunthala engineering college, Avadi, Chennai 600062, India. ,*Corresponding Author, 2 Professor, Department of Civil Engineering, Veltech Hitech

Dr Rangarajan Dr Sakunthala engineering college, Avadi, Chennai 600062, India. 4 Assistant Professor, Department of Civil Engineering,

Dr. M.G.R. Educational and Research Institute University Chennai 600095, India

E.Mail 1 nandhakumar@gmail.com, 3pulikutty2000@yahoo.co.in, 2 tamilselvi_05@yhoo.com 4 sp.ilango@yahoo.co.in Ph 1 9490294701, 3 9840062899, 2 9840123624 and 4 9791116736

ABSTRACT Today concrete is most widely used construction material due to its good compressive strength and durability. Depending upon the nature of work the cement, fine aggregate, coarse aggregate and water are mixed in specific proportions to produce plain concrete. Self-curing concrete is one of the special concretes in mitigating insufficient curing due to human negligence paucity of water in arid areas, inaccessibility of structures in difficult terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete. The present study involves the use of shrinkage reducing admixture polyethylene glycol in concrete which helps in self-curing and helps in better hydration and hence strength. In the present study, the effect of admixture on compressive strength, split tensile strength and modulus of rupture by varying the percentage of admixture by weight of cement from 0%,0.75%,1%,1.25%,1.5% were studied M35 mix with 5% of steel fibre. It was found that PEG admixture could help in self-curing by giving strength on par with conventional cured concrete. It was also found that 0.75% of admixture for weight of cement was optimum for M35 grade concrete with and without steel fibre for achieving maximum strength without compromising workability. It is also found that steel fibre gives more strength than conventional concrete.

Key words: Concrete, admixture, fibre, self-curing concrete

FEASIBILITY STUDY ON PUBLIC BICYCLE SHARING IN EASTERN PARTS OF BENGALURU

Mohammed Sahil Khalifa Civil Department PES University Bangalore, India mskhalifa007@gmail.com Manjunath Bandi Civil Department ES University Bangalore, srimanjunatha23@gmail.com Prashantha Civil Department PES University Bangalore, saprashantpm@gmail.com J S Vishwas Assistant Professor Civil Department PES University Bangalore, vishwajs@pes.edu

Abstract— Public Bicycle Sharing (PBS) system is achieving worldwide attention as an important climate-friendly, active transport alternative. PBS was a huge success when it was introduced in Paris in the name of Velib. Recently, in India, the PBS was launched in Mysuru city of Karnataka for the first time under the title Trin-Trin by Government of Karnataka. The extended PBS system in Karnataka is now introduced in Bengaluru under the identical title and completed its Phase-1 planning. This paper aims to study the feasibility factors involved in the currently ongoing phase-2 planning of PBS in Bengaluru. The study involves a series of surveys carried for certain feasibilities considered. The results from these surveys would help in making the decisions before the planning of the next phase of PBS Keywords—Public bicycle sharing, active transport,TrinTrin, phase-2 planning, feasibility study .

EXPERIMENTAL INVESTIGATIONS OF SHEDI SOIL (LITHO-MARGIC CLAY) WITH LEACHATE INTERACTION

Manjunath.R Dr. E.T Arasu Dr.Umadevi B Rakshith K Department of Civil Engineering Department of Civil Engineering Department of Civil Engineering Department of Civil Engineering Ramaiah Institute of Technology Ramaiah Institute of Technology Ramaiah Institute of Technology Ramaiah Institute of Technology Bengaluru, Karnataka, India Bengaluru, Karnataka, India Bengaluru, Karnataka, India Bengaluru, Karnataka, India manjunath.thr@gmail.com manjunathr@msrit.edu

Abstract. The impact of leachate from dumpsites poses a drastic change and a serious threat to nearby surrounding soil. The level of contamination of leachate defines the degree of impact on engineering properties of soil. The present study defines shedi soil from a nearby dumpsite collected at a depth of 1.m from ground level and its interaction with leachate in different concentrations studied. Basic tests were performed on soil samples with and without leachate addition. The compaction test results reveal the density increases with leachate addition. The shear strength of soil increases initially and decreases up to 50% addition of leachate. The leachate collected from S.Bingipura dumpsite in Bangalore which 6years old formed due to decomposition of segregated waste in Dumpsite. The investigation reveals the leachate gradually modifies the engineering behavior of soil. The dry density increases due to increase in crystalline structure of soil due to metals ions in leachate.

Keywords: Shedi soil, leachate, dumpsites, compaction, shear strength

EXPERIMENTAL INVESTIGATIONS OF BLACK COTTON SOIL WITH LEACHATE INTERACTION

Manjunath.R Dr. E.T Arasu Dr.Umadevi B Sai Yashas.G M Department of Civil Engineering Department of Civil Engineering Department of Civil Engineering Department of Civil Engineering Ramaiah Institute of Technology Ramaiah Institute of Technology Ramaiah Institute of Technology Ramaiah Institute of Technology Bengaluru, Karnataka, India Bengaluru, Karnataka, India Bengaluru, Karnataka, India Bengaluru, Karnataka, India
manjunath.thr@gmail.com

Abstract. The leachate produced from dump wastes results in the changing factor of many engineering properties of soil. The top soil up to certain depth being the base for agricultural usage, leachate is responsible to change all the required properties of good soil. A clear understanding of leachate interaction with different kinds of soil being very essential factor at this time due to uneven disposal of waste in all the parts of state. The present study is responsible to identify one of the most important type of soil: Black cotton soil and its interaction with leachate and its effect on the engineering properties of soil is carried out. The test results reveal varying concentration of leachate which affects the compaction to a great extent. The shear strength properties gradually vary after certain percentage of leachate addition. The leachate combinations with black cotton soil need to be avoided due to large variation in physio- chemical properties of soil

Keywords: Black cotton soil, leachate, Standard compaction test, Shear strength test.

Flexural Performance of Reinforced Concrete Beam with Layer of Strain Hardening Cementitious Composites

A.R.Krishnaraja Department of Civil Engineering Kongu Engineering College Erode, India krajacivil@gmail.com S.Anandakumar Department of Civil Engineering Kongu Engineering College Erode, India anandkeccivil15@gmail.com M.Jegan Department of Civil Engineering N.S.N College of Engineering and Technology Karur, India jegan1064@gmail.com S.Kandasamy Department of Civil Engineering Government College of Technology Coimbatore, India swamykandhan@gmail.com

Abstract - This research paper focus on development of new hybrid engineered cementitious composites (ECC) and to study the mechanical and flexural performance of newly developed Hybrid ECC in the tension zone of RC beams. In this study, five different combinations are used in RC beam. The main objective of hybridization is to improve the flexural, energy absorption and ductile performance of RC beams. ECC with Polyvinyl Alcohol (PVA) fiber and ECC with Polypropylene (PP) fiber with 2% volume fraction are the two mono fiber mixes. Hybridization is made with PVA (0.65%) and PP (1.35%), PVA (1%) and PP (1%), PVA (1.35%) and PP (0.65%). In this study, the material properties of mono fiber ECC with 2.0 % of PVA is kept as the reference mix. From the results, it has been observed that the mix with PVA fiber of 1.35% volume fraction hybrid with PP fiber of 0.65% volume fraction exhibit improvements in flexural strength when compared with conventional concrete. However PP fiber of 2% volume fraction has high energy absorption capacity and PVA fiber of 2%volume fraction has high ductile displacement compared to conventional concrete.

Keywords - ECC, Polyvinyl Alcohol Fiber, Polypropylene Fiber, Energy Absorption, Pullout Test

EXPERIMENTAL INVESTIGATION ON REINFORCED SOIL

K.K.Akshay1,VernekarSamarth1,RoaBhoomikaN1,ShettyShavinSatish1,PatelShreyas1,SrinathShetty2,Anil Kumar3
1U.Gstudent,DepartmentofCivilEngineering,NMAMIT,Nitte,Karnataka,India 1
akshaykk998@gmail.com
2Professor,DepartmentofCivilEngineering,NMAMIT,Nitte,Karnataka,India
2shettysrinath@nitte.edu.in
3Asst.Professor,DepartmentofCivilEngineering,NMAMIT,Nitte,Karnataka,India
3kumaranil@nitte.edu.in

Abstract— Expansive soils, popularly known as black cotton soils in India are, amongst the most problematic soils from Civil Engineering construction point of view of the various factors that affect the swelling behavior of these soils, the basic mineralogical composition is very important. Most expansive soils are rich in mineral montmorillonite and a few inillite. The degree of expansion being more in the case of the former. Black cotton soil is heavy claysoil, varying from clay to loam; it is generally light to dark grey in colour. Cotton grows in this kind of soil. The soil prevails generally in central and southern parts of India. The most important characteristic of the soilis, when dry, it shrinks andishardlikestoneandhasveryhighbearing capacity.Thelithomargicsoil(shedisoil)isalso anexpansivesoilfoundineasternandwestern regionofIndia.itisalsoweakinstrengthand loosesitscapacitywhenitcomesincontactwith water. Thedesirableengineeringpropertiesare notgoodandbehaviorisunpredictableespecially when they are saturated.The load carrying capacity is also very less and in orderto overcome this the reinforcement has been introduced. In this work we have taken fiber mesh as the reinforcing material. By providing fiber mesh at suitable depths the load carrying capacity can be increased. In this work by providing fiber mesh at equal heights of the depth with single material the load carrying capacity can be increased in black cotton soil and lithomargic soil.

Keywords—Black cotton soil, Lithomargic soil, fiber mesh, Unconfined compressive test

Nitrate Contamination in Groundwater and assessment of Hazard coefficient: A Case Study of K.R. Puram area in Bangalore, India

Shankar B S Dept of Civil Engineering. Gopalan College of Engineering and Management Bangalore, India shanky5525@gmail.com Latha Sanjeev Dept of Civil Engineering Gopalan College of Engineering and Management Bangalore, India latanjeev@gmail.com

Abstract— Water containing nitrate levels above 45 mg/l is not recommended for human consumption and its prolonged intake is associated with various critical health conditions. The present study was carried out to evaluate the nitrate contamination in the groundwater and ascertain the associated health impact on the communities in the K.R. Puram area of Bangalore, India. A total of 30 groundwater samples each were collected from the study area, during the pre and post monsoon periods of 2017, where the groundwater is the main source of drinking water. Statistical analysis indicates that the concentrations of nitrate in groundwater range from 6 mg/l to 394 mg/l with a mean of 90.97 mg/L during pre-monsoon; 6 mg/l to 418 mg/l with a mean of 101.7 mg/l during postmonsoon. 60 % of groundwater samples are unfit for drinking purpose with respect to nitrate concentrations exceeding the BIS permissible limits. Furthermore, noncarcinogenic risk of nitrate incurred by drinking contaminated groundwater in the area was estimated by using the USEPA human health risk assessment method. Since infants are the subpopulation most susceptible to nitrate induced methemoglobinemia, the assessment was limited to that age group children. 25 samples with high nitrate concentrations belong to the domains of the hazard quotient index>1, indicating the higher health risk in 83.33% of these sampling sites. Therefore, there is a clear need for implementing effective strategies to protect groundwater quality and to better manage and control nitrate pollution sources.

Keywords— contamination, groundwater, nitrate, health risk, water supply

Optimally Locating Rain Harvesting Pits Using GIS as A Tool

M. Madhuri[1] and P. Sai Shraddha[2]
[1,2]Assistant Professor, Department of Civil Engineering in Vignan Institute of Technology and science, Deshmukhi, Hyderabad.

Abstract
The conventional means to record hydrological parameters of urban flood often fail to record the operation of flood mapping and flood risk assessment. GIS plays a major role in the management of multi-dimensional natural hazard with an inherent spatial component. GIS generates a visualization of flooding and also creates possibilities to analyze probable damage estimate of the urban flood. Hence, there's got to review the present literature with a holistic read of managing varied prospects and constraints of using the technology of remote sensing and GIS of flood management. This study focuses on identifying the least elevation point for locating rain harvesting pit optimally using GIS.

Keywords: Urban Flood Control, Rain Harvesting Pits, GIS.

I. INTRODUCTION

Urban flooding is the most common problem arising in an urban area during the monsoon season due to high-intensity rain falls. Improper drainage system, defective flood water disposal techniques do not have the necessary capacity to drain the amounts of rainwater that is falling. Sometimes the water disposed of in sewage system leaks on the roads through the drainage manholes results in foul smell, growth of bacteria and other sewage troubles.

Urban flooding creates immense troubles like traffic congestion due to water stagnation on roads, roads accidents, economic damages, etc. During heavy rains, the water slowly rises on roads and flows towards slopes resulting in water stagnation at lowest points. Quick rainwater disposal from the road surface is essential to maintain the quality and lifespan of the road. The installation of a suitable drainage system is an essential part of urban road design and construction.

Disposing of rainwater is an important feature in the determination of pavement ability to withstand the traffic and environmental effects. Other than the rainwater pavements experience poor conditions due to many other reasons out of which poor drainage is one of the reason. The strength, ability, and performance of pavement decrease with increase in moisture content. Defective drainage system causes premature failure of the pavement. Due to the lack of supportive infrastructure, the rainwater is not quickly getting disposed of resulting in damage of road structure.

Greater Hyderabad Metropolitan City with 10 million population is the most urban flood-affected areas is specific in the fact that has a lack of drainage issues and rainwater disposal problems. To overcome these problems a keen observation is needed hence this study focuses on identifying the optimal location for rain harvesting pits for Mansoorabad area by analyzing the three-dimensional data using Arc GIS software as a tool.

II. GEOGRAPHICAL INFORMATION SYSTEM

Geographical information system is an application of acquisition satellite data remotely which contains earth information. Through this information one can study, access and analyze various topographical parameters of earth. Recent advancements in this technology helping the researchers to utilize the application for studies related to transportation planning, flood monitoring, land use planning etc.

Various GIS software's are available in the market applied for wide varieties of data. For carrying out this study Arc GIS 10.1 Software is utilized to study the DEM (Digital Elevation Model) of the study area.

III. DATA COLLECTION

Greater Hyderabad is recognized as the most populated urban area in our country experiencing heavy urban flooding during monsoon. Heavy traffic congestion, delays, and economic losses. Mansoorabad area comes under the zone where the rainwater stagnation percentage is high. The 3 Dimensional data of the chosen study area is gathered using Arc GIS 10.1 in the following steps:

Fishnet

Create a fishnet tool generates a feature class of a rectangular grid cell creating three sets of basic information. a fishnet is created of grid size 200m X 200m covering an area of 9 Sqkms for the chosen study area as shown in figure 1.

ISBN: 978-93-8830-599-0

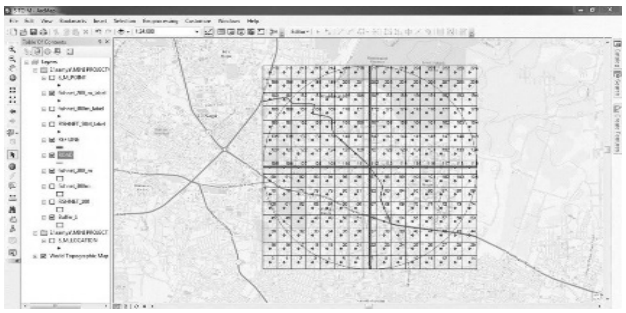


Fig. 1 Fishnet Created of grid size 200m X 200m

From the generated fishnet a total of 200 fishnet label points are produced along with it for which the elevation values and X, Y coordinate values have to be extracted. Usually, the X,Y coordinates are taken as latitudes and longitudinal values, here in this study the X, Y values are taken are the distances of the fishnet label point from the axis to identify the path the water flows during the flood.

Slope calculation

The slope can be calculated from elevations extracted from fishnet grid cells. The slope is defined as an angle. Slope measure the steepness of the surface at any particular location is often measured in percent rise of ground from MSL. In this study, the slope of the ground is estimated from an online web tool called GPS Visualizer.

From the generated fishnet label points, label point layer is convertedtoKMLformat for the extraction of three-dimensional data covering the latitude, longitude and elevation data using GPS Visualizer. The extracted elevation points are labeled on map and bifurcated into 4 quadrants anti-clockwise direction for easy identification of rain harvesting pit location as shown in figure 2.

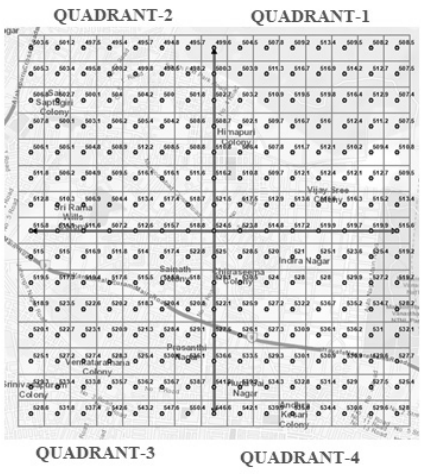


Fig. 2 Labelled elevation points in the map

IV. METHODODOLOGY

The optimal location is found out by adopting a statistical equation called the method of moments. In this methodology, the feasible location for a Rain harvesting pit is identified by using the formula, elevation values of the nodes E_1, E_2, E_3… multiplied by horizontal and vertical distances i.e. X1, X2, X3… and Y1, Y2, Y3.... taken from the reference line (0,0). The optimal location points can be calculated from the below-presented formula.

$$X = \frac{E_1x_1 + E_2x_2 + \cdots..}{E1 + E2 + E3 + \cdots}$$

$$Y = \frac{E_1y_1 + E_2y_2 + \cdots..}{E1 + E2 + E3 + \cdots}$$

The x and y coordinate values obtained in four quadrants for each point are a substitute in the formula mentioned. The outputs received are mentioned in table 1

Table 1 Output Values after substituting in the method of moments formula.

QUADRANT	X^-	Y^-
1	798.290306	806.220242
2	-799.848895	796.111672
3	-798.2903	-806.2202
4	799.0301	-818.519

From the result obtained the value of X^-, Y^- are known from 4 node points. Hence it will be opted as low-level land and used as the optimal location for facility location. Comparing with the graphical real-time data the values X^-, Y^- gives the exact locality for placing a pit rather than any other methods. Hence, it can be taken as a feasible location for locating a Rain harvesting pit. Below figure 3 shows the map plotted with values of identified X and Y values

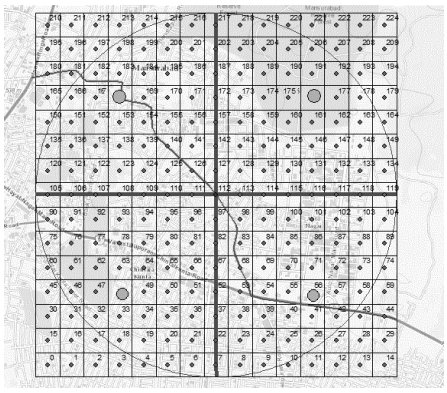


Fig. 3 Optimal locations of rain harvesting pits

ISBN: 978-93-8830-599-0

V. RESULT

The obtained X^-, Y^- satisfy as the lowest elevation points which represent the flow direction of water during the flood. Hence these location points serve as the optimal places to place the rain harvesting pits for disposing of the flood water in various methods and helps in avoiding traffic congestion, delays and pavement surface failures.

VI. CONCLUSION

This study concludes that through GIS-based analysis of land slope analysis and positioning of rainwater harvesting pits is very much useful in future planning of the decision support system of rainwater harvesting. This kind of GIS-based analysis helps in identifying the water flow path to plan accordingly the supportive infrastructure for its easy disposal and storage.

REFERENCES

1. Swathi Vemula, K. Srinivasa Raju, S. Sai Veena, A. Santosh Kumar "Urban floods in Hyderabad, India, under present and future rainfall scenarios: a case study"
2. Ahmed Z, Rao DRM, Reddy KRM, Raj YE (2013) Urban flooding-case study of Hyderabad global journal of engineering. Des Technol 2:63–66
3. GHMC Disaster Management cell (2018) http://www.ghmc.gov.in/Disaster.aspx. Accessed in July 2018
4. Chatterjee M (2010) Slum dwellers response to flooding events in the megacities of India.
5. GPS Visualizer an online map utility http://www.gpsvisualizer.com/
6. Zameer Ahmed , D. Ram Mohan Rao , Dr.K.Ram Mohan Reddy, &Dr. Y. Ellam Raj " urban flooding – case study of Hyderabad"
7. Wan B, James W (2002) SWMM calibration using genetic algorithms. In: International conference on Global Solutions for Urban Drainage. American Society of Civil Engineers.
8. T.I. Eldho, ... A.T. Kulkarni, in Integrating Disaster Science and Management, 2018 " Urban Flood Management in Coastal Regions Using Numerical Simulation and Geographic Information System ".
9. Jeffrey scott broke June 2015 " locating optimal water quality monitoring locations using demand coverage index method ".
10. Guide on Artificial Recharge to Groundwater, Ministry of Water Resources, New Delhi,2000
11. Sayed Joinal Hossain Abedin and Haroon Stephen " GIS Framework for Spatiotemporal Mapping of Urban Flooding"
12. Sunmin Lee, ID , Saro Lee , ID , Moung-Jin Lee,ID and Hyung-Sup Jung. " Spatial Assessment of Urban Flood Susceptibility Using Data Mining and Geographic Information System (GIS) Tools".
13. Sarup, Jyoti, and Vimal Shukla."Web-Based solution for Mapping Application using Open- Source Software Server." International
14. HuiminLiua,b, , Qingming Zhana,b, Meng Zhan " the uncertainties on the gis based land suitability assessment for urban and rural planning"
15. Bhaskar, N.R., James W.P., and Devulapalli, R.S (1992)."Hydrologic Parameter Estimation Using Geographic Information System (GIS)", *Journal of Water Resources Planning and Management*, ASCE,118(5),492-512.

ISBN: 978-93-8830-599-0

Compative Study on Acid Resistance of Geopolymer Concrete to Conventional Concrete

P. Sai Shraddha[1] and M. Madhuri[2]

[1,2]Assistant Professor, Department of Civil Engineering, Vignan Institute of Technology and science, Deshmukhi, Hyderabad

Abstract

Growth of Environmental pollution is a serious issue to be addressed in the global scenario. Among the Major industries contributing to the Pollution, a Cement industry contributes to around 5% of Carbon dioxide emissions globally. Hence there is a need to use substitute material for cement which reduces this impact on Environment. Geopolymer concrete is made utilizing binder materials like Flyash, Silica fume, rice husk ash, GGBS, Metakaolin etc., and Alkali Activator solutions. This paper deals with the study on chemical resistance of Geopolymer concrete when compared to conventional concrete. Sulphuric acid is chosen for attack in this study since it can cause both acid and sulphuric attack on concrete matrix. The test results of present study compares the resistance offered by ordinary Portland cement concrete and geo-polymer concrete.

Keywords: Geopolymer, Flyash, Acid resistance, Sulphuric acid.

I. INTRODUCTION

Among the several vital properties of hardened concrete, Durability plays a major role as it influences the life of structures. Reaction and resistance of concrete to the aggressive environment quantifies durability of hardened concrete. Durability of hardened concrete can be characterized as its capacity to resist Chemical attack, weathering action, wear and tear while retaining its designed engineering properties. Chemical attack on concrete can be explained under acid attack, Chloride attack, Alkali aggregate reaction, Sulphate attack, carbonation etc., Sulphur attack can occur due to association between concrete and sewage water or sea water or Ground water containing sulphates. Soil contains Sulphates in many forms mainly as magnesium sulphate, calcium sulphate, Ammonium sulphate, Potassium sulphate and Sodium sulphate. Generally sulphates present in solid form does not cause any significant damage to concrete but when present in dissolved form reacts with hydration products of concrete. Calcium sulphate causes unsubstantial deterioration due its low soluble nature while magnesium sulphate causes greater deterioration by reaction with calcium hydroxide and hydrated calcium aluminates. This reaction causes deterioration of cement paste volume in the concrete matrix and converts concrete in to granulated and powdered mass.

Even though Ordinary Portland Cement is the broadly utilized component in construction industry, its resistance to Chemical attacks is a noteworthy concern. In the recent studies binders of Geopolymer concrete has been found to be more effectively resisting the chemical attack apart from environmental friendliness. Geopolymer concrete is made utilizing binder materials like Flyash, Silica fume, rice husk ash, GGBS, Metakaolin etc., and Alkali Activator solutions. Generally either Sodium Hydroxide, Sodium silicate solutions or Potassium hydroxide , Potassium silicate solutions can be used as Alkali activator Solutions. In this study Flyash based Geopolymer concrete is made using Sodium hydroxide and Sodium silicate solutions. Coal based thermal power plants produce Flyash. It is a powdered residue originating from oxidization of powdered coal. Amorphous silica in flyash triggers the Pozzolanic activity. Geo-polymer concretes have alumina-silicates as binder and they generally do not have free lime. Therefore their resistance to acids can be estimated to be superior to the Portland cement based concrete.

II. MATERIAL CHARACTERISTICS

Tests on materials used for preparation of conventional concrete and Geopolymer concrete are conducted in order to find the material properties.

(a) Cement: Ordinary Portland Cement (OPC) of 53 grade is used for preparation of conventional concrete of M30 grade. Specific gravity of cement is tested and found to be 3.15 using Density bottle method. Different properties of cement are tested and the results are discussed in Table 1.

Table 1 Properties of OPC 53 grade cement

S.No	Material property	Test result	Specifications (IS 12269:2013)
1	Specific gravity	3.15	3.0-3.2
2	Soundness using Le chatelier's method	4	Should be less than 10mm
3	Normal consistency	33%	—

Contd…

ISBN: 978-93-8830-599-0

S.No	Material property	Test result	Specifications (IS 12269:2013)
4	Initial setting time	30 min	Should not be greater than 30min
5	Final setting time	560 min	Should not be greater than 600min
6	Percentage of cement retained on sieve no.9	5%	Should not be greater than 10%

(b) Coarse aggregate: Durability against chemical attack of a concrete depends not only upon the cement characteristics but also on the properties of Aggregate. Specific gravity of the Coarse aggregate is found as 2.67 using density basket apparatus. Coarse aggregate size used for casting of both conventional and Geopolymer concrete is 20mm.

(c) Fine aggregate: Locally available sand passing through 4.75mm IS sieve is used for casting. Specific gravity of sand is found as 2.67 using Pycnometer bottle method. The zone of sand is confirmed to be Zone III sand in accordance with IS 383-1970.

(d) Flyash: Fly ash is generally available as Class C and Class F type. Active compounds in addition to calcium alumina-silicate glass that may be present in Class C fly ash are free lime, an hydrate, tricalcium aluminate, calcium sulfo-aluminate, and rarely, calcium silicates. Low calcium (Class F) fly ash characteristically contain a large proportion of silicate glass of high silica content plus crystalline phases of low reactivity. Hence as Class F flyash contains low or no free lime content it is selected as binder in this study. Composition of flyash used in this study is discussed in Table 2.

Table 2 Composition of Class F Flyash

Constituent	Composition/Percentage
Cao	0.72-3.6
SiO_2	49-67
Al_2O_3	16-28
Fe_2O_3	4-10
MgO	0.32-2.6
SO_3	0.1-1.9

(e) Alkali Activator Solutions: Alkaline environment is essential for the initiation of geopolymer binder reaction. Sodium hydroxide solution in combination with Sodium silicate solution or Potassium hydroxide solution in combination with Potassium silicate solution are generally used as Alkali Activator Solutions.

Sodium hydroxide solution: Sodium hydroxide is available in the form of pellets, flakes, sticks or chips and in solutions of different concentrations and purities. Sodium hydroxide solution in combination with Sodium silicate solution is most commonly used because Sodium hydroxide is abundantly available at low cost.

Sodium Silicate solution: The preparation of sodium meta silicate is done for 33.3% concentration by mixing Sodium meta silicate powder in water.

III. EXPERIMENTAL STUDY

Mix design: The grade of concrete used in this study is M 30. Conventional concrete mix design is adopted according to IS 456:2000. Mix proportions of Geopolymer concrete used in this study are presented in table 3.

Table 3 Mix proportion of Geopolymer Concrete

Ingredients of Geo-polymer concrete	Quantity (Kg/m^3)
Fly ash	405
NaOH	70.88
Na_2SiO_3	70.88
sand	683.13
Coarse aggregate	1268.66
Total water	108.35
Extra water	29.46

Mixing and Casting: The preparation of sodium hydroxide solution is done for 13 M by mixing 520grams of sodium hydroxide pellets in 1 litre of distilled water. The preparation of sodium hydroxide solution is an exothermic in nature. The preparation of sodium silicate solution is done by mixing 590 grams of sodium meta silicate powder in 1litre of water. 97% purity of sodium meta silicate powder is used. Alkali Activator solutions are prepared 24 hours prior to mixing of Geopolymer Concrete.

Weigh Batching is adopted for accounting the materials. Concrete mixer machine is used for mixing the materials. Flyash, Coarse aggregate and Fine aggregate are thoroughly mixed in dry state. After attaining a homogenous dry mixture alkali activator solutions and free water content are added. A decent mixing is carried out before placing the fresh Geopolymer Concrete mix in moulds. Conventional concrete is mixed and cast according to IS 10262:2009. Cube specimen moulds of size 150x150x150mm and Cylinder specimens of diameter 300mm and height 150mm are used for casting the specimens. A Thin

ISBN: 978-93-8830-599-0

layer of grease or waxing agent is applied to the mould for easy demoulding of specimens.

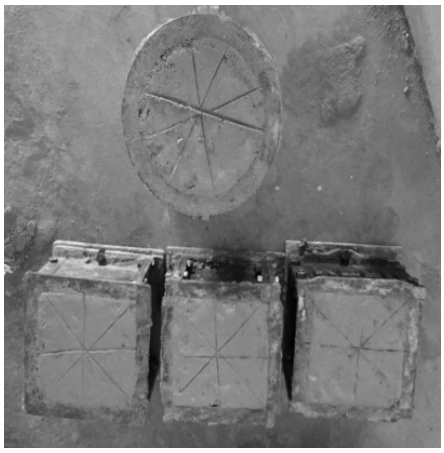


Fig. 1 Casting of Geopolymer specimens

The specimens are demoulded after 24hours of cast. Conventional concrete specimens are Water cured for 28 days. Geopolymer concrete specimens oven cured for 24 hours at 60^0C.

Fig. 2 Demoulded concrete specimens

After 24 hours of oven curing the specimens are air cured for 28 days and tested for compressive and Split tensile strengths.

Fig. 3 Testing of Concrete Specimens

Concentrated sulphuric acid (98% and density of 1.84 g/cc) was used to prepare the diluted sulphuric acid of 10%concentration.Conventional concrete and Geopolymer Specimens are immersed in Sulphuric acid after 28 days for a week period and tested for the compressive and split tensile strength.

Fig. 4 Concrete specimens immersed in Sulphuric acid

IV. RESULTS

Conventional concrete cubes are removed from curing tank before 4-5 hours of testing and surface dry condition is ensured. Cubes and Cylinder specimens are placed in Compression Testing Machine and tested. Compressive strength Results are presented in table 4.

Table 4 Cube strength of conventional concrete specimens before and after Acid attack

Cube	Cube Strength (N/mm^2)	Cube Strength after immersion in acid (N/mm^2)
C1	30.22	19.55
C2	30.22	20
C3	30.67	20.44
C4	31.11	20.88
C5	31.11	20.88
C6	30.22	20
C7	30.67	20.88
C8	31.11	20.88
C9	30.67	21.33
C10	30.67	21.77

Table 5 Split Tensile strength of conventional concrete specimens before and after Acid attack

Cylinder	Cylinder strength(N/mm^2)	Cylinder Strength after immersion in acid (N/mm^2)
CY1	3.8	2.26
CY2	3.53	2.12
CY3	3.39	2.41

ISBN: 978-93-8830-599-0

Geopolymer Concrete Cubes has lost their texture and appearance, revealing the aggregates in them after exposing to the acid environment.

Table 6 Cube strength of Geopolymer concrete specimens before and after Acid attack

Cube	Cube Strength(N/mm^2)	Cube Strength after immersion in acid (N/mm^2)
GC1	30.67	22.22
GC2	30.22	21.33
GC3	31.11	22.22
GC4	31.56	22.22
GC5	31.11	21.78
GC6	30.67	22.22
GC7	31.11	22.22
GC8	31.11	21.78
GC9	31.11	21.33
GC10	31.11	22.22

Table 7 Split Tensile strength of Geopolymer concrete specimens before and after Acid attack

Cylinder	Cylinder strength(N/mm^2)	Cylinder Strength after immersion in acid (N/mm^2)
GCY1	3.54	2.83
GCY2	3.54	2.69
GCY3	3.68	2.97

Comparision of Conventional concrete and Geopolymer concrete specimens are graphically presented below.

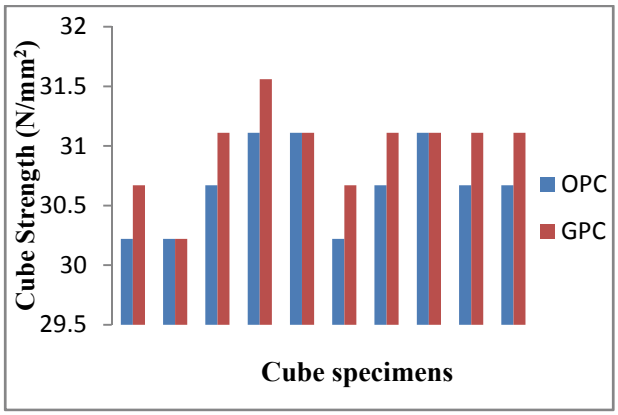


Fig. 5 Compressive Strength Comparison of cubes before Acid attack

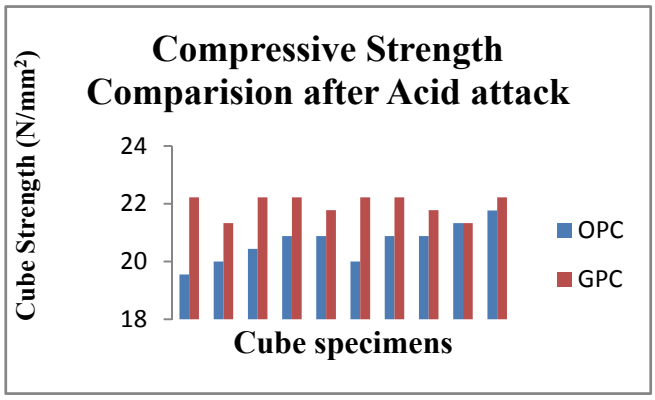


Fig. 6 Compressive Strength Comparison of cubes after Acid attack

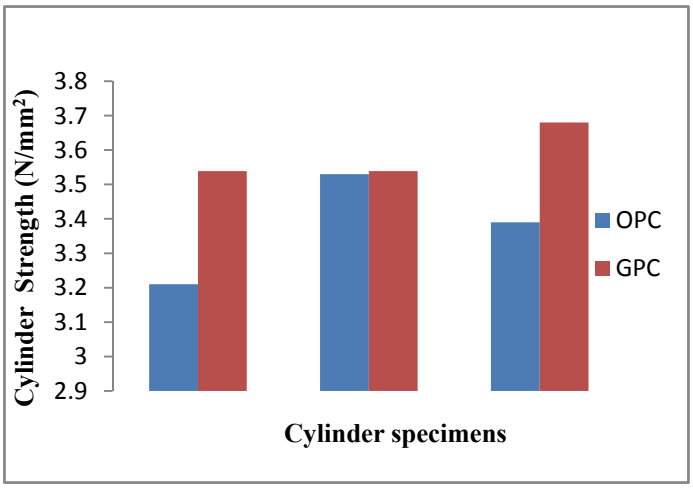


Fig. 7 Split tensile Strength Comparison of cubes Before Acid attack

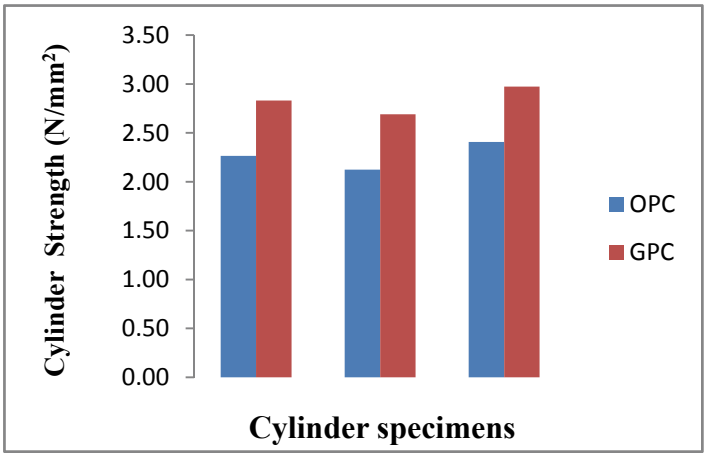


Fig. 8 Split tensile Strength Comparison of cubes after Acid attack

V. CONCLUSIONS

The average of 28days compression test of GPCs were in the range of 30.2 to 31.11 MPa. The corresponding values for OPCCs were 29.33 to 30.67 MPa

ISBN: 978-93-8830-599-0

respectively. It may be noted that this strength levels are quite adequate when compared with the minimum structural grade recommended in IS456-2000 for extreme exposure condition.

GPC specimens has maintained their shapes without any signs of severe external deteriorations but the GPCs had strength losses of 28.49% which is quite considerable. OPC concrete specimens had almost lost their shape with many locations of severe externally visual deteriorations; the strength losses were very high i.e; 35%. The OPC concrete specimens has exposed coarse aggregates, the surfaces were rough and whitish in color. Expansive chemical reaction should have happened in the Conventional Concrete specimens since a perceptible increase in the diameter of the specimens was noticed. These specimens could be considered as having reached their ultimate level of integrity. In contrast the GPC specimens were intact even though significant strength losses have occurred. From the above results, it is clear that GPC mixes have comparatively high resistance to Sulphuric acid attack. This can be ascribed to the fact that the Geopolymer Concrete do not have free lime content in its components and Geopolymer themselves are not easily attacked by the acids. Conventional concrete do contain free lime content in its components and are easily attacked by the acids.

REFERENCES

1. Steenie E. Wallah, Djwantoro Hardjito “Performance of Fly Ash-Based Geopolymer Concrete under Sulfate and Acid Exposure”.
2. P Abhilash, C Sashidhar and I V Ramana Reddy “Evaluation of performance of Geopolymer Concrete in acid environment”.
3. Salmabanu Luhar “Durability Studies of Fly Ash Based Geopolymer Concrete”.
4. Sanjukta Sahoo, B. B. Das, A. K. Rath and B. B. Kar “Acid, Alkali and Chloride Resistance of High Volume Fly Ash Concrete”
5. S. Kumaravel[1], K. Girija “acid and salt resistance of geopolymer concrete with varying concentration of NaoH”
6. Mr. K. Madhan Gopal, Mr. B. Naga Kiran “Investigation on Behaviour of Fly Ash Based Geopolymer Concrete in Acidic Environment”.
7. T Srinivas, N V Ramana Rao “studies on acid attack resistance of low calcium flyash and slag based geopolymer concrete”
8. Davidovits, J., (1994), Properties of geopolymer cements, Proceedings of first International conference on alkaline cements and concretes.
9. P. Chindaprasirt, U. Rattanasak, S. Taebuanhuad, Resistance to acid and sulfate solutions of microwave-assisted high calcium fly ash geopolymer.
10. Davidovits, J.,(2002), 30 years of successes and failures in geopolymer applications-Market trends and potential breakthroughs, Proceedings of the geopolymer.
11. Suresh Thokchom, Dr. Partha Gosh and Dr. Somnath Gosh, (2009), Acid resistance of fly ash based geopolymer mortars, International Journal of Recent Trends in Engineering.
12. Mittal A, Kaisar MB, Shetti RK. Experimental study on use of fly ash in concrete. 2005; 1–22.
13. Naik TR, Singh SS, Hossain MM. Properties of high -performance concrete systems incorporating large amounts of high-lime fly ash. Construction and Building Materials. 1995 Aug; 9(4):195–204.
14. Naik TR, Sivasundaram V, Singh SS. Use of high volume class F fly ash for structural grade concrete. 1991; 23–34.
15. Poon CS, Lam L, Wong YL. A study on high strength -concrete prepared with large volumes of low calcium fly ash. Cement and Concrete Research. 2000 Mar.
16. Thirugnanam GS. An experimental investigation on the mechanical properties of bottom ash concrete. Indian Journal of Science and Technology. 2015May.
17. Reddy BSK, Varaprasad J, Reddy KNK. Strength and -workability of low lime fly-ash based geopolymer -concrete. Indian Journal of Science and Technology.
18. Allahverdi Ali, Skavara Frantisek. 2006. sulfuric acid attack on hardened paste of geopolymer cements. Part Corrosion mechanism at mild and relatively low concentrations.
19. Song X.J, Marosszeky M, Brungs M, Munn R. 2005. Durability of fly ash based geopolymer concrete against sulphuric acid attack. 10 DBMC International Conference on Durability of Building Materials and Components.
20. Wallah S.E, Rangan B.V. 2006. Low Calcium Fly ash based Geopolymer Concrete: Long term properties.

ISBN: 978-93-8830-599-0

Research Report GC 2, Curtin University of Technology, Australia.

21. Davidovits, J., Geopolymers: Inorganic Polymeric New Materials. Journal of Thermal Analysis,1991. 37: p. 1633-1656.
22. Davidovits, J. Properties of Geopolymer Cements. Presented at the First International Conference on Alkaline Cements and Concretes. 1994. Kiev, Ukraine.
23. Davidovits, J. High-Alkali Cements for 21st Century Concretes. Presented at the V. Mohan Malhotra Symposium on Concrete Technology: Past, Present And Future. 1994. University of California, Berkeley: ACI.
24. van Jaarsveld, J.G.S., van Deventer, J.S.J., and Lukey, G.C., The effect of composition and temperature on the properties of fly ash- and kaolinite-based geopolymers. Chemical Engineering Journal, 2002. Article in press: p. 1-11.

ISBN: 978-93-8830-599-0

Grenze International Journal of Engineering and Technology, Special Issue

Thermal Analysis of TBC Coated Superalloy for Industrial Gas Turbines

Mohammed Asadullah[1],Mohammed Yunus[2],Shobab.A[3] and Swetha ramadugu[4]
[1, 3, 4]Asst. Prof Department of Mechanical Engg Methodist College of Engg Abids Hyderabad 500001 India
[2]College of Engg and Islamic Architecture,Ummal Qura University,Abidiah,Makkah,KSA

***Abstract*—There is a continuous effort undergoing for improvement in efficiency of gas turbine from past few years since these engines are used in transportation, energy, power fields etc. The improvements in gas turbine efficiency can be achieved at high inlet temperature by using thermal-barrier coatings (TBCs). Due to expectations of obtaining higher efficiency there is continuous research and development happening across the globe in this field. The present paper discusses about the need of coating technologies and characteristics of TBC materials for improving the performance of gas turbines. The comparison of two types of coating process used on the blade surface of gas turbines has been explained for certain important parameters.**

***Index Terms*— Gas turbine; Thermal Barrier Coatings (TBC); Guide vanes; Super alloy.**

I. INTRODUCTION

The gas turbine is a device that converts energy obtained by combustion of fuel into mechanical power which runs a generator to produce electrical power. There exist several parts in gas turbines like combustor, blade, guide vanes which are subjected to high temperatures. Earlier the focus was on combustor of gas turbines later it shifted to blades of turbines. The efficiency of turbine is related to turbine inlet temperature, as the inlet temperature increases the efficiency also increases. In order to improve the efficiency of turbine thermal barrier coating is used. These coating (TBCs) are ceramic coatings made of refractory-oxide that are applied to the surfaces of metallic parts. TBC are applied to the parts which are subjected to very high temperatures in a gas turbine as shown in the Figures 1 and 2. Gas turbines yield more output, higher engine efficiency and thrust to weight ratio when TBC is used. There is continuous effort under progress to obtain the most efficient TBC material which gives optimum results.

Gas turbine engines are highly expensive of billion of USD industry around the globe (2010) in which 65% used for jet engines and 35% for land based engines to generate electricity [1]. The gas turbine faces challenges when improving its efficiency since the inlet temperature cannot be increased to any limit. The utilization of TBC is very much required since approximately 25% of all electricity in the United States and 20% worldwide are produced by natural gas [2]. With rapid developments in gas turbines the air traffic is expected to grow double in next 20 years [3]. Another challenge is to reduce the NOx emission caused by jet engines at higher altitude [4].

Figure 3 shows the different layers in TBC (a) Top coat (TC) (b) bond coat (BC) (c) Super alloy or base metal. The superalloy or base metal is made of Nickel,Tallium or Cobalt based alloys. Inconel alloy is ideal

Grenze ID: 01.GIJET.4.3.21

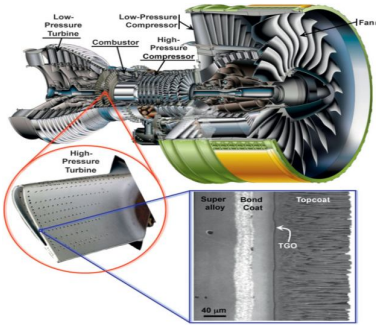


Figure 1. Pictorial view of Gas turbines showing coated with TBC super alloy

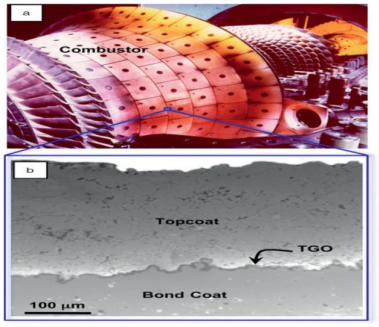


Figure 2. Pictorial view of (a) Combustor and (b) blade blade coated with TBC coat followed by bond coat and

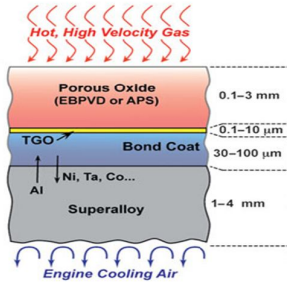


Figure 3. Different layers of coating and their thicknesses

for applications in high temperature applications. They withstand higher mechanical stresses and strains under various challenging conditions to provide protection against corrosion and creep. The melting point of Inconel is 1400^0C.BC is oxidation resistant metallic layer 75-150µm in thickness. It is generally made of NiCrAlY or NiCoCrAlY alloy. At peak temperatures the temperature of base metal exceeds 700^0C resulting inBC oxidation. Ceramic TC provides thermal insulation which is made of MCrAlY where M stands for Ni or Co. The most common type of material used in this layer is Y_2O_3 stabilized Zirconia. This material YSZ has lowest thermal conductivity 2.3 w/mK at 1000^0C for fully dense material. It also has high thermal coefficient of expansion $11x10^{-6}$ / ^{0}C, density 6.4mg/ m^3,hardness of 14GPa and very high melting point 2700^0C.

The coating act as thermal insulation to superalloy and protect them against severe conditions while working. There are many parts in gas turbines like combuster, guide vanes, blade, outer air seals and shrouds (fig-1).The developments in these parts were done earlier by several techniques like single crystal Ni-based superalloys, but developments of TBC along with cooling see much improvement in the performance. There are two main process adapted for coating gas turbine blades made of super alloy, namely,

- Air Plasma Spraying.
- Electron Beam Physical Vapor Deposition.

Air Plasma Spraying method is used commonly for directing blades, nozzle vanes and other elements of the combustion chambers. Electron Beam Physical Vapor Deposition technique is used for the rotating blades since they are under high thermal stresses. This process produces columnar grain structure which is most preferable. The comparison of APS and EBPVD process is shown in the Table 1 for coating Yittrea stabilized zirconia.

TABLE I. ROOM TEMPERATURE PROPERTIES OF YSZ TC (REF -7)

Properties	Process	
	EBPVD	APS
Surface roughness,µm	0.5-1	4-10
Thermal conductivity w/m/k	1.5-1.9	0.8-1.1
Adhesion strength, MPa	400	20-40
Young's modulus, GPa	90	200
Erosion rate	1	7

The APS and EBPVD techniques are the most effective among all since there is reduction of thermal conductivity as shown in Table 1. If the temperature of gas becomes higher than melting point of base metal, failure of TBC can cause severe damage to the engine [5].

II. Experimental Methodology

A specimen made of nickel based alloy Inconel 718 was used as a substrate with each sample of size 30mm diameter and 3mm thickness. Figure 2 shows cross section of a gas turbine engine and a turbine coated by thermal-barrier coating (TBC), and it also shows the cross section of the coated blade in high resolution 40µm under scanning electron microscope (SEM).The TBC coating is done by an electron beam physical vapour deposition process for 7YSZ. Figure 4 shows graph of temperature variations used in gas turbine over the period of time for Ni base superalloys. The curve at bottom level brown in colour obtained for Ni based alloys working at lower temperature having low temperature withstanding abilities. Green line shows TBC coated superalloy with maximum temperature value and red line shows superalloy cooling with tbc having better performance than earlier two methods.

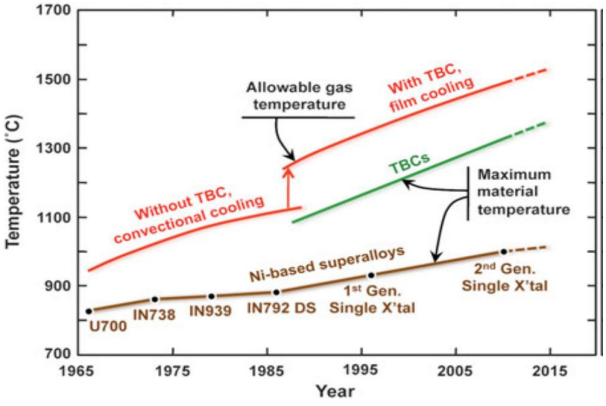


Figure 4. Temperature variations used in gas turbine over the period of time for Ni base super alloys

The YSZ tbc has certain properties like low thermal conductivity , high coefficient of thermal expansion which makes it most preferred coating material however there are more investigations needed to find alternative material other than YSZ which possess still lower thermal conductivity than YSZ.The conductivity can be changed by change in crystal structure or by change in composition. Heat transfer through the TBC coating depends upon factors such as electronic conduction, lattice phonons, and radiation. TBC materials that are selected for coating usually have low electrical conductivity. Thus electronic conduction has very less significance. And at temperature below 1250^0C less than 10% of heat transfers by radiation therefore lattice phonons has been considered for improving the performance of TBC.

III. Results and Discussions

The platinum modified nickel aluminide BC was subjected to thermal cycles by electron beam physical vapor deposition method it shows TGO thickening and local stress shown in images taken by SEM (Figure 5.).This thermal cycles were done at 1150^0C.The photoluminescence piezo-spectroscopy technique [7] was used to measure mean stress on TC (Figure 6). When a compressive stress is applied the peak positions of photoluminescence spectrum shift to lower frequencies, if a tensile stress is applied it shift to higher frequencies. This photoluminescence piezo-spectroscopy provides a noncontact measure of the stress in alumina-containing materials.Bond coat function is to provide Al diffusion to prevent oxidation and reduce TGO thickness formation. The BC should also not react with TBC coating. There exist two types Ni-rich nickel aluminide and a more complex in composition MCrAlY alloy. Since the TC YSZ is good conductor of oxygen thus oxidation of BC is unavoidable.

In order to prevent creep TGO should remain elastic to the highest temperature.TGO should also not react with superalloy. AL2O3 is the oxide layer that grows very slowly and also has good mechanical integrity.

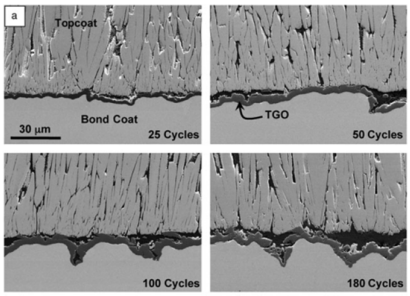


Figure 5

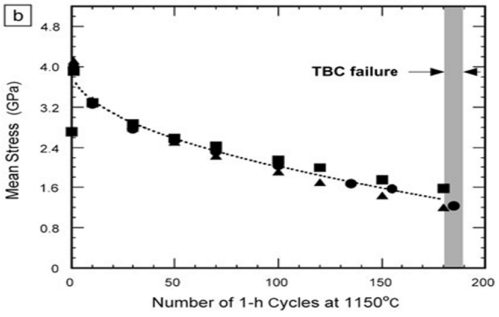


Figure 6

The most rigorous constraints are forced on the BC in many respects. To form a protective α -Al $_2$ O $_3$ TGO, BC's primary function is to provide a reservoir from which Al can diffuse while maintaining cohesion with the TBC without reacting with it. Mechanics modeling [8] indicates that, ideally, the TGO should remain elastic to the highest temperatures and not creep to prevent "rumpling" [9 ,10] or cavitation on thermal cycling [11] would happen into separations of bond and TC at the TBC interface (Figure 5). Also, it has to operate at the highest possible temperature along with reduced air quantity which requires for cooling the vanes and blades without reacting with the underlying super alloy and melting. This means that the maximum bond-coat temperature cannot be allowed to exceed 1150°C. There are two main bond-coat alloys currently in use, a Ni-rich nickel aluminide and a more complex in composition MCrAlY (M=Ni, Co + Ni, or Fe) alloy. While these are alloys metallurgically differ to face the similar challenges such as to minimize deformation at intermediate and operating temperatures, minimizing inter diffusion with the underlying super alloy which prevents the formation of brittle inter metallic, and delivering critical elements along with Al, Hf and Y, to the increasing Thermal gas oxide (TGO) layer for minimizing inelastic plastic deformation under thermal fatigue.

Estimation of the TBC system's performance is very essential in terms of the configuration, growth, and properties of the TGO developed beneath the 7% YSZ topcoat due to oxidation of the BC alloy. TBC microstructures revealed surface flawed with porosity and a crack, 7% YSZ is an oxygen conductor, that allows the oxidation of the BC. The BC compositions are required to develop very slow growing oxide at high temperatures like α -Al_2O_3 TGO which forms non porous act as adhesive layer with exceptional mechanical reliability. As TGO grow beyond a critical thickness, the failure of TBC occurs due to the loss of consistency of epitaxial thin films which discharge the elastic strain energy stored in the TGO film grown beyond the fracture strength [12]. Two reasons for the stress induced in the TGO layer due to (1) development of strain of new oxide film and (2) the disparity of stress level between the stress induced by super alloy and differences in thermal expansion upon cooling.

TGO develops due to two components of strain growth leading to (1) simple thickening and (2) tangential TGO growth which causes decrease in plane stabilities and resistance to mechanical properties [11]. Tangential growth of strain initiation is difficult to understand and endorsed to the opposite movement of inside diffused oxygen and outside of the layer Al^{3+} result into the coating of new Al $_2$ O $_3$ inside the TGO grain boundaries [13]. Studies revealed that a number of measurements on the TGO growth of strain did not consider TBC itself using x-ray synchrotron experiments and not enough to follow the progress during thermal oxidation or cycling. Photoluminescence piezo-spectroscopy measurements revealed the details of TGO strain growth when measured from the TC [14] where a laser beam penetrates the TC to stimulate the *R* -line luminescence using traces of Cr 3+ ions which are invariably exist. The average TGO stress is relative to the frequency change of the *R* -lines. The correlations by mapping the luminescence shifts and the growth of dent as the BC and TGO rumple are shown in Figures 5 and 6.

IV. Conclusion

In this paper, thermal analysis of TBC coating using TGO growth has been explained in respect of YSZ coating. Various terminology and parameters involved in growth TGO layer has been discussed and some important measurement processes are explained. various unattempted questions remained on the tangential strain growth whose decree could influence oxidation of other than super alloys including size of elements effecting the growth and mechanical properties. mostly study of the elements Y, Zr, and Hf that separate

each other due to their difference between ionic radii on the TGO grain boundaries are to be carried out. These elements to be tested whether they alter the anti diffusion along the TGO grain boundaries creating tangential strain growth effect the high-temperature creep and plasticity.

REFERENCES

[1] F.M. Pitek , C.G. Levi , *Surf. Coat. Technol*. **201** , 6044 (2007).
[2] M.A. Alvin , F.S. Pettit , G.H. Meier , N.M. Yanar , M. Chyu , D. Mazzotta , W. Slaughter , V. Karaivanov , B. Kang , C. Feng , R. Chen , T.C. Fu , in *5th International Conference on Advances in Materials Technology for Fossil Power Plants*
[3] J.L. Smialek , F.A. Archer , R.G. Garlick , *JOM* **46** (12), 39 (1994).
[4] F.H. Stott , D.J. de Wet , R. Taylor , *MRS Bull.* **19** (10), 46 (1994).
[5] M.P. Borom , C.A. Johnson , L.A. Peluso , *Surf. Coat. Technol.* **86** – **87** , 116 (1996).
[6] S. Krämer , J.Y. Yang , C.A. Johnson , C.G. Levi , *J. Am. Ceram. Soc.* **89** (10),3167 (2006).
[7] Wen QZ, Lipkin DM, Clarke DR (1998) Luminescence characterization of chromium-containing theta-alumina. J Am Ceram Soc 81:3345–3348.
[8] W.E. Ford , in *Dana's Textbook of Mineralogy with an Extended Treatise on Crystallography and Physical Mineralogy, 4th Edition* (Wiley , New York ,1954).
[9] K.M. Wessels , R.W. Jackson , D.G. Konitzer , T.M. Pollock , C.G. Levi ,presented at the International Conference on Metallurgical Coatings and Thin Films, San Diego, CA , 2012 .
[10] L. Li , D.R. Clarke , *Int. J. Appl. Ceram. Technol.* 5 (3), 278 (2008).
[11] W. Braue , P. Mechnich , *J. Am. Ceram. Soc.* 94 (12), 4483 (2011).
[12] PTI , "Material Safety Data Sheet: Airport Runway Sand" (2007); www . powder technologyinc . com / secondary / msds . php .
[13] F.N. Rhines , J.S. Wolf , *Metall. Mater. Trans. A* 1 , 1701 (1970).
[14] P.Y. Hou , A.P. Paulikas , B.W. Beal , *JOM* 61 , 51 (2009).

Grenze International Journal of Engineering and Technology, July 2018

Design and analysis Light Weight Foldable cycle

Prasad .Matam [1], Y.Madhu M.Reddy[2]
[1,2] Methodist college of engineering and technology/Mechanical engineering Department, Hyderabad, India
Email: prasadmatam@gmail.com[1] mmr315@gmail.com[2]

***Abstract*— Bike is perceived as a transportation arrangement enhancing different natural, financial and social perspectives. An assortment of bike plan and setups for utility are utilized to convey individual assets, basic supplies, youngsters and significantly more. One specific utility bike is the folding bike. Its plan enables clients to effortlessly transport the bike utilizing less space when the bike is "collapsed" in to a minimal size. When utilizing a folding bike with a bike travel, it enables people capacity to board travel vehicles. The adaptability of a collapsing bike is additionally suitable for air travel and for when deficient stopping and bike burglary is a noteworthy concern.In this paper, I am going to do design and analysis of a foldable bicycle with reference to the humming bird cycle which is the lightest bike in the world .in this project main aim to make design of cycle which is less than the hummingbird using different materials for the chassis and technology to make it less weight**.

***Index Terms*— Humming Bird Cycle , Solid Works ,Ansys ,Different Materials**

I. INTRODUCTION

In the present day lifestyle man is not able to dedicate specific time for his health, importance is least given to exercise and body fitness due to time shortage and stressful life. Obesity is one of the common issues seen in the society, which leads to many health hazards. Exercises are advised for health promotion, and treatment for many diseases. Transport has been one of the major issues in developing cities since commuting from one place to another has become tedious and expensive. With the petrol and diesel prices increasing day by day, almost all the modes of transport are becoming expensive. It is difficult to reach the nearest public transport facility and in many cases the destination will be far from the main roads where the public transport might not be able to reach due to the small roads, to avoid which most people use vehicles of their own, which in turn leads to issues with parking, traffic, etc. But not all can opt for having own vehicles as it is expensive. With such issues in health, transport, space for parking, etc. one solution that comes to mind is bicycle. Bicycles are being promoted in the corporate and educational sectors. But how convenient is it to use a conventional bicycle? In many cases there is no special facility provided for locking the bicycles and even if one is present, it is probable to theft, which is one of the fears that obstruct use of bicycle. Conventional bicycles occupy sufficient space and hence providing one at work place or at home are quite difficult. They are probable to be exposed to the weather outside and do require frequent maintenance. With all such issues in the conventional bicycles, the next possible solution is the usage of foldable bicycle. With foldable bicycles, there is no issue since the bicycle can be folded and carried around to the work place or even it can be used to reach the nearest public transport facility and then folded and carried along. Since the bicycle is being folded, it occupies very less space and doesn't require any special parking space. They are not exposed to the weather since they can be carried inside buildings with ease and hence prone to less maintenance. The usage of foldable bicycle helps combine the different modes of transport as mentioned above, which helps in cutting down some cost involved in travelling. Foldable bicycles are available in the market, but are expensive since they are being imported. There are very few recognized foldable bicycle manufactures in India. Hence we ceased the opportunity to provide a low cost, locally manufactured foldable bicycle. A folding bicycle is a bicycle designed to fold into a compact form, facilitating transport and storage. When folded, the bikes can be more easily carried into buildings, on public transportation and more easily stored in compact living quarters or aboard a car, boat or plane. Folding mechanisms vary, with each offering a distinct

combination of folding speed, folding ease, compactness, ride, weight, durability, and price. Distinguished by the complexities of their folding mechanism, more demanding structural requirements, greater number of parts, and more specialized market appeal, folding bikes may be more expensive than comparable non-folding models. The choice of model, apart from cost considerations, is a matter of resolving the various practical requirements: a quick easy fold, a compact folded size, or a faster but less compact model There are also bicycles that provide similar advantages by separating into pieces rather than folding

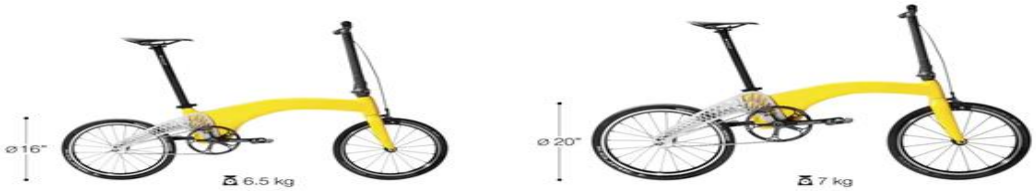


Fig:1 Foldable Bicycle

II. METHODS OF FOLDING

Half- or mid-fold

Many folding frames follow the classic frame pattern of the safety bicycle's diamond frame, but feature a hinge point (with single or double hinges) allowing the bicycle to fold approximately in half. Quick-release clamps enable raising or lowering steering and seat columns. A similar swing hinge may be combined with a folding steering column. Fold designs may use larger wheels, even the same size as in non-folders, for users prioritizing ride over fold compactness. Bikes that use this kind of fold include Dahon, and Montague, and Tern.

Vertical Fold

Instead of folding horizontally, this style of bike has one or two hinges along the main tube and/or chain and seat stays that allow the bike to fold vertically. The result leaves the two wheels side by side but is often more compact than a horizontally hinged design. The Brompton and Dahon Speed Uno both feature vertical folding.

Triangle hinge

A hinge in the frame may allow the rear triangle and wheel to be folded down and flipped forward, under the main frame tube, as in the Bike Friday, Brompton Mezzo Folder, and Swift Folder. Such a flip hinge may be combined with a folding front fork, as in the Birdy. Swing and flip hinges may be combined on the same frame, as in the Brompton Mezzo Folder and Dahon, which use a folding steering column. Folding mechanisms typically involve latches and quick releases, which affect the speed of the fold/unfold. Bike Friday offers a model, the Tikit, featuring a cable-activated folding mechanism requiring no quick releases or latches, for increased folding speed.

Magnet folding and suspension system

A magnet combined with a rear shock absorber forms the folding mechanism. The magnet connects and locks the back wheel section to the frame. To fold the bike in half, the magnet disconnects with one movement and in a second, and without having to use one's hands, the rear wheel rotates forward, and the bike folds vertically. This mechanism also enables one to roll the half-folded bike on its rear wheel.

Advantages of a Folding Bike

- Easy to take on public transport due to small size
- Less worry about it being stolen since you can take it in anywhere
- Perfect for small apartments or condos since it doesn’t take up much space
- Some will fit in carry-on luggage for a flight

Advantages of Buying a Road Bike

- Usually cheaper than a folding bike
- You can go faster on this type of bicycle
- You can get a better fitting frame for your body
- Overall, the ride is more comfortable

III. AIRLESS' NEXO SYSTEM

One of the most annoying things a cyclist can be faced with is a flat tyre. But soon, bikers will no longer have to carry around a pump, puncture repair kit and inner tube. Two new kinds of tyre have been developed that claim to never go flat. Utah-based Nexo, has created two types of tyres - named Nexo and Ever Tires - that are not affected by holes or slashes, it claims. The two tyres, on sale on Kick-starter. Prices for the tyres start out at $76 (£61) for an Ever Tires wheel set at 20 to 24 inches, and can reach up to $360 (£289) for any set of four tyres of any size. Flat-free tyres are not completely new, but they are not widely used because of poor stiffness and shock absorption compared to conventional ones. But Nexo's new tyres hope to tackle these problems, while also reducing the number of tyres and tubes that are thrown away each year. Ever Tires are designed with huge holes around their sides, made of a polymer blend called 'Nexell' that the company has invented .Nexell claims to offer cushion, resilience and durability. Every Tires can last for 5,000 miles (8,048km), but cyclists wishing to buy these will need to buy a whole new wheel. The Nexo tyre does not have prominent holes, which means it can be attached to existing wheels, but only last 3,100 miles (4,988km).

Fig:2 Air less Nexo tyres

IV. MODELLING OF A BICYCLE USING SOLID WORKS SOFTWARE

SOLIDWORKS is a solid modeling computer-aided design (CAD) and computer-aided engineering (CAE) computer program that runs on Microsoft Windows. SolidWorks is published by Dassault Systèmes.

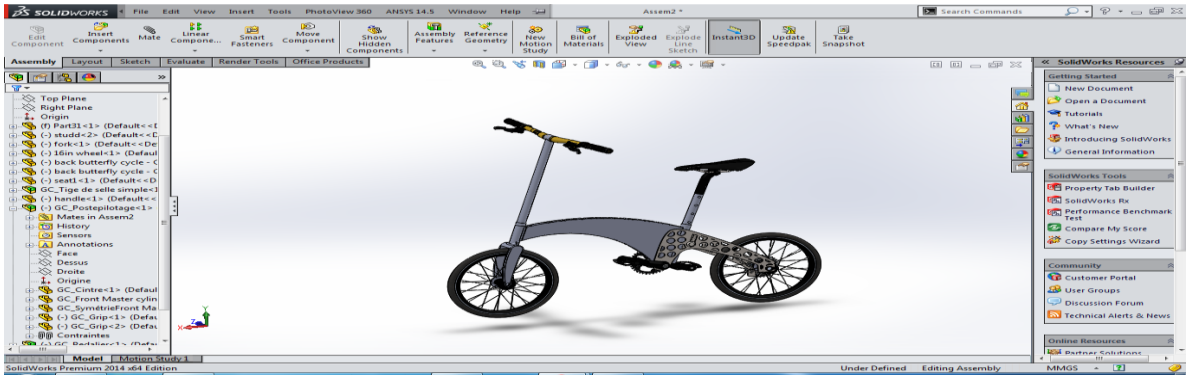


Fig:3Assembly of cycle

Fig: 4 Rendered image of the cycle

Fig :5 Folded view of the cycle

Fig:6 Rendered image of the cycle with back ground

V.ANALYSIS USING ANSYS WORKBENCH SOFTWARE

In this paper analysis is done with the different materials applied on the rear and front frame of the cycle to check the deformation, stress, strain on it by applying the 980N of load on it.

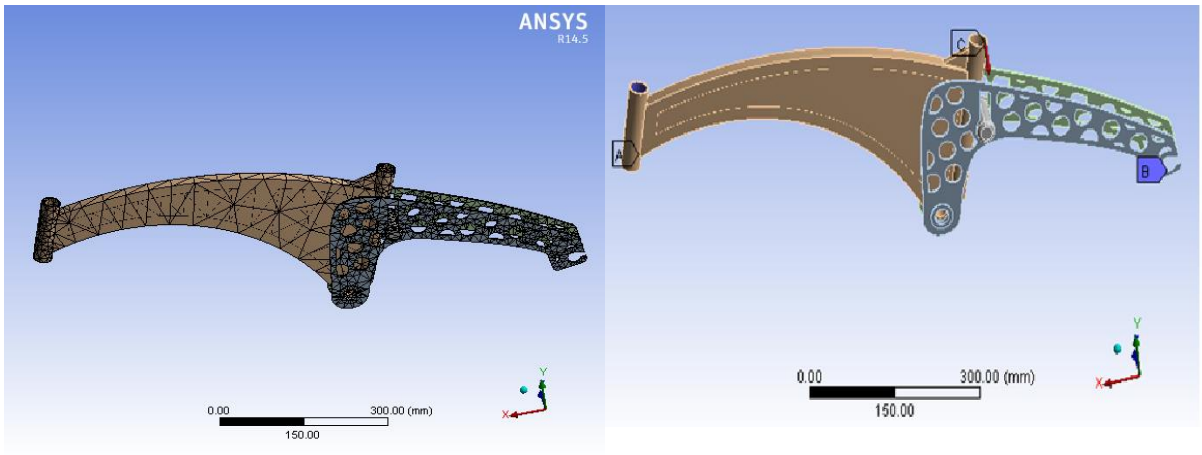


Fig:7 Meshing and Boundary conditions applied to the frame

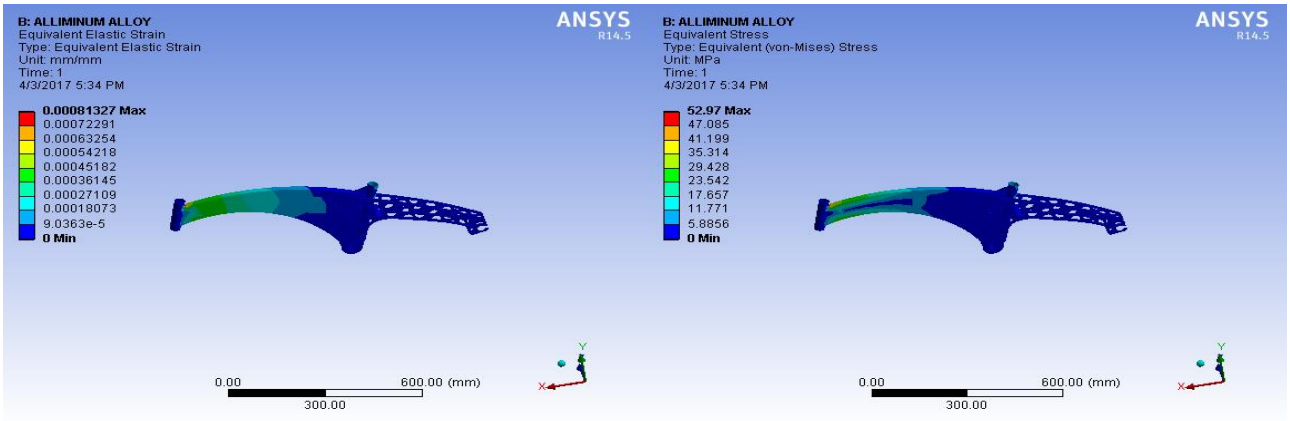


Fig: 8 Equivalent elastic strain and Vonmises Stress

VI RESULTS

Material	Total deformation	Stress	Strain
Steel	1.47569 mm	53.795 mpa	0.00029295 mm/mm
Aluminium	1.3395 mm	52.97 mpa	0.00081327 mm/mm
Titanium	0.99006 mm	52.119 mpa	0.00059245 mm/mm

From the above table it is observed that out of different materials used in the frame, Titanium has good properties, but cost point of view aluminium is the best because deformation and stress doesn't have much difference between Aluminium and Titanium.

.

VII References

1. "Physical Culture – Gear Test, Folding Bikes". *The New York Times. 24 June 2009.*
2. "Separable-frame bicycles". *Moulton Bicycle Company.*
3. "Folding Bike History". *Folding Cyclist.*
4. **J** "Various Pedersen Models". *Dursley Pedersen Cycle. Mads Rasmussen*. Retrieved 2009-09-22.
5. The Bicycle, UK, 13 September 1944
6. http://hummingbirdbike.com
7. "1939-1945 WW2 BSA 'Airborne Bicycle' Folding Paratroopers Para Bike".
8. "The History of the Folding Bike". *The Folding Cyclist*. Retrieved 2013-06-06.
9. *Guinness World Records (2000 Millennium ed.). 2000. p. 301.*
10. "A Commuter's Secret Weapon". Business Week. *Archived from* the original *on 17 May 2009*. Retrieved 2009-06-12.
11. "The Advantages of Small Wheels on a Bicycle". *Livestrong.com*. Retrieved 2014-01-06.

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
(An Institute under Ministry of HRD, Govt. of India, New Delhi)
Ashok Rajpath, Patna – 800005

Dr. Ramakar Jha
Chair Professor & Head
Department of Civil Engineering

Email: rj@nitp.ac.in, rjha43@gmail.com
Tel.: +91 0612 269130 (Ext) 122(O)
Web site: www.nitp.ac.in

To,

Dear **M.Bal, M.Purnima, Dr. B.Naik, and Dr. S.N.Sahoo**

Subject: (a) Acceptance of Research Paper for ORAL Presentation
(b) Submission of Registration Fee for its publication in Proceedings

Ref.: Paper No. 443 (Effect of land use and runoff characteristics in Rourkela city using SWMM5.1)

It is my pleasure to inform you that your above referred research paper has been accepted for ORAL PRESENTATION in the very prestigious International Conference HYDRO-2018-INTERNATIONAL.

You are requested to kindly make online payment of Registration Fee for at least one Author and Co-authors attending the Conference and send the duly filled Registration Form by 25th October 2018. **The research papers are likely to be published in the Proceedings (Springer) only after the receipt of registration fee from the author.** E-poster Template is attached too.

Looking forward to see you in HYDRO 2018 International at NIT Patna.

With kind regards,

(PROF. (DR.) RAMAKAR JHA)

Chair, HYDRO-2018-INTERNATIONAL

hydro2018international@gmail.com

Effect of land use and runoff characteristics in Rourkela city using SWMM5.1

M.Bal[1], M.Purnima[2], B.Naik[3],S.N.Sahoo[4]

[1]*M.Tech Student, Department of Civil Engineering, CAPGS, BPUT, Rourkela, India*
[2] *M.Tech Student, Department of Civil Engineering, CAPGS,BPUT, Rourkela, India*
[3] *Faculty, Department of Civil Engineering, CAPGS, BPUT,Rourkela,India*
[4] *Assistant Professor, Department of Civil Engineering,NIT,Rourkela,India*
Email:manishabal1962@gmail.com
Telephone/Mobile No.: +918280192780

Abstract

This study examined the effects of land use and land cover changes due to urbanization on the annual direct runoff of Rourkela city. Urbanization is the index of the transformation of the rural areas to the developed new industries. The land cover (Built-up Area) change caused due to different activities in Rourkela City and its surroundings. For this purpose, 6 digital images are used for the years 2002, 2003, 2009, 2010, 2011, and 2015. These images are analyzed using the data processing techniques in ArcGIS software – Arc Map 10.1. Remote sensing can provide a better picture of monitoring land use and land cover changes. These maps revealed that the watershed experienced conversion of approximately 16% non-urban area to urban area between 2002 and 2015. The Storm Water Management Model (SWMM) was used to calculate direct runoff generation. The model was repeatedly run with different urbanization scenarios to investigate the hydrological response to land use changes. The simulation results of SWMM model for the various urbanization scenarios indicate that when the impervious surface area changed from 21.05% of 2002 scenario to 32.56% of 2009 scenario, the average annual direct runoff depth would increase from 988.26 mm to 1881.71 mm. The results also indicate that the annual direct runoff depth is highly correlated with the percentage of impervious surface area. When impervious surface area is less than 25%, the annual direct runoff depth will increase linearly with impervious surface area *(R^2 =0.86);* however, when impervious surface area is greater than 25%, the annual direct runoff depth will also increase linearly with impervious surface area (R^2 = 0.81) but at much lower rate.

Keywords: *SWMM, Arc GIS, Runoff, LULC, Remote sensing, Percentage of impervious*

1. Introduction

From the last few decades, the established and developed countries both have observed rapid urbanization. Due to this a range of complex problems are arising which is linked to the management of surface runoff and storm-water in the cities. Along with the enlarged impervious tiles of the urban region the water percolation to soil, infiltration, transpiration, depression storage and underground water table are absent and this results plane runoff and flooding in the cities roads and it's adjacent. The discharge through point and non-point sources which badly affects the water quality parameters of storm-water and runoff. If this drainage water is not

managed appropriately, it may lead to economic sufferers, spread of diseases, drop of water quality in rivers and receiving waters due to the frequent flooding of municipal areas. Sustainable Urban System (SUDs) is a methodical approach to create the surface drain and storm water in a manner that will decrease the possible impact of new development and improvement with respect to the discharges**.** Land use and land cover (LULC) alteration has a major impact on water resources. At a watershed scale, LULC change due to urbanization can increase runoff, flooding, and nonpoint source pollution and can degrade downstream water bodies. Thus it is essential to assess the probable hydrologic impacts of LULC change former to watershed improvement. To evaluate the hydrologic impacts of LULC change at a revolution point scale, many hydrological models have been developed such as the Storm Water Management Model (SWMM), and Soil and Water Assessment Tool (SWAT) Cell Based Long Term Hydrological Model and Hydrologic Engineering Centre's Hydrologic Modelling System (HEC-HMS), Technical Release 55. To assess the long-standing impacts of LULC changes on the hydrology of a sub catchment, some of these models mention above require many types of data inputs and parameter evaluation that are usually not readily accessible for land-use planners. Therefore, it is necessary to develop a much easier-to-use model to evaluate hydrological. The raise in population density and construction density affect the most visible manipulate on hydrological processes in a municipal area. Adaption of the land surface during urbanization alters the storm-water runoff explanation. The major alteration which alters the runoff process is the impervious surfaces of the catchment such as roofs, sidewalks, roadways and parking lots, which were early pervious. Another aspect is the natural channels, which were in being before urbanization, are often straighten, deepened and lined to make them hydraulically smoother. Gutters, drains and storm drainage pipes are laid in the urban area to convey runoff rapidly to rivulet channel. These increase flow velocities, which directly influence the timing of the runoff hydrographs. The combined effect of all these changes is to ease the lag time of runoff. Since a overweight volume of runoff (due to urbanization) is discharged within a shorter period interval, the peak discharge inevitable increased. Due to urbanization, administration of urban water is very difficult. Customary drainage has many disadvantages like disorder of water balance, include to of runoff and flooding downstream, loss of groundwater recharge and base flow, increases heat land mass sound effects due to loss of evapo-transpiration and pollute acceptance water bodies by oils, pure substances and heavy metals etc. The following paper focused on the integrated approach to sustainable urban drainage system (SUDS) by Using Storm Water Management Model (SWMM 5.1). SUDs are deliberate to planning and management strategies to control quality and quantity of storm water or plane runoff intend to overcome the problems of long-established drainage system. Sustainable drainage network is used to be modelled and analysis by Storm Water Management Model SWMM 5.1. It is a complete simulation model used for lively rainfall runoff calculations for shorter and longer time span to calculate the runoff quality and quantity of metropolitan region.

2. Material and Methods

2.1. Study Area

Rourkela, one of India's most important industrial cities, is located in Sundergarh district of western Odisha. The city lies between Latitude 22°25'N and Longitude 84°00'E in the heart of the mineral belt of the state. The area is rich in iron ore and due to this reason has many industrial plants located here. The city is well thought-out Odisha's commercial capital because

of the presence of the steel industry. The Steel authority of India (SAIL) has one of its biggest plants -The Rourkela Steel plant is located here. population in the surrounding areas is mostly tribal Rourkela has a hilly and undulating topography .The city was once surrounded by forests and today there are two reserved forests around the area of the city. The steel city is divided mainly into two sections: Old Rourkela (sections of the city near the railway station that were settled prior to RSP coming up) and the much larger Steel Township. The Steel Township till 1999, was divided into 18 Sectors, Sector 6 being the largest of them. The Steel Township and Fertilizer Township are under the Steel Plant Administration while the other sections of the city are under the Rourkela Municipal Corporation. Some rural areas of South Rourkela are managed by the Jalda Panchayat. Central Water Commission has its sub-divisional headquarters near Panposh.Rourkela has a tropical climate and receives high rainfall during Southwest monsoon (June – September) and retreating Northeast monsoon (December – January). Average annual rainfall ranges between 160 and 200 cm. The minimum and maximum temperatures are in the range of 5 C to 49.7 C with a mean minimum and maximum temperature range of 12.0 C to 31.5 C during coldest and hottest months. Thirty six percent of the geographical area of the district has semi-evergreen or tropical dry deciduous forest. The fig.1 and fig.2 represent that Rourkela city and Global location of Rourkela respectively.

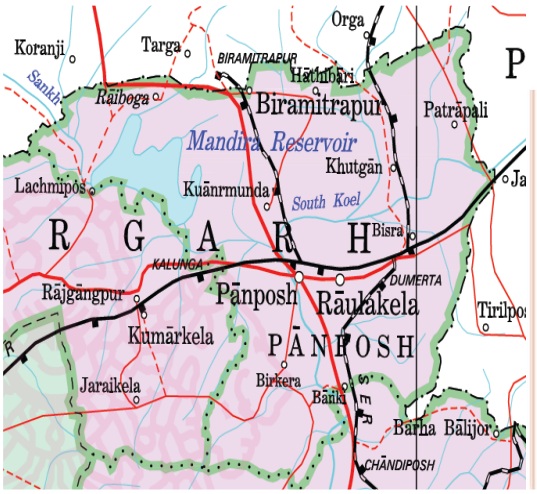


FIG.1:- Rourkela City

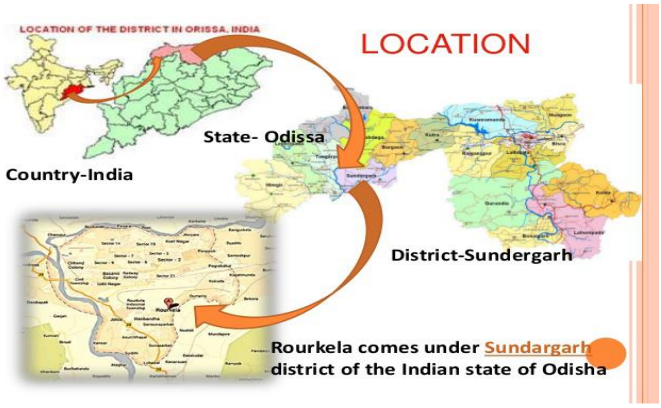


FIG.2:-Global location of Rourkela

2.2. Data Acquisition

In this study, totally, seven LULC classes were established as Forest, Agricultural Land Built up Area (Commercial, Industrial, Public Utility, Residential, and Transport), Barren land, Water Bodies.

2.2.1. LULC study of Rourkela city

LULC maps of 2002, 2003, 2009, 2010, 2011 and 2015. In order to analyze hydrological effects of urbanization, the urbanization scenarios were built by overlaying each impervious surface of 2002, 2003, 2009, 2010, 2011, and 2015 to the land use map. That way, the hydrologic effect of urbanization could be assessed, avoiding the effects cause by all other land use change. The changes in direct runoff with different urbanization scenarios were analyzed, and the relationship

between annual direct runoff and the impervious surface area was investigated. Five land cover module namely Forest land, Built up area, Water Bodies, Agricultural Land, Barren land are identified in the study area. The table 1 represents that land use types of Rourkela city from year 2002 to 2015.

Table 1:- Land use types of Rourkela city from year 2002 to 2015

Year	Forest	Agricultural land	Built-up area	Barren land	Water bodies
2002	22.56	53.17	20.01	1.8	2.16
2003	22.32	52.74	21.02	1.65	2.25
2009	20.56	51.73	24.05	1.44	2.58
2010	20.13	50.61	26.03	1.26	1.97
2011	19.86	49.83	26.93	1.03	2.35
2015	18.04	47	32.56	0.86	1.54

2.3. Model Configuration

It is feasible to classify the variables and parameter in to two categories as sub catchment characteristics and hydraulic characteristics.

2.3.1. Sub catchment characteristics

In sub catchment characteristic Sub catchment area, average of sub catchment width, average width of overland flow path, average slope, , impervious and pervious area, infiltration and depth of depression storage on impervious and pervious area, Manning roughness coefficient were resolute based on the properties of the studied area, related formulas, complementary tables and recommendations presented by SWMM model. Depth of depression storage on impervious and pervious area parameters has been extracted from the values recommended by ASCE, (1992). Manning roughness coefficient was obtained from ASCE (1982) manual. Land use map was collected from e- thesis, NIT Rourkela. Based on land use map, five classes of land use include i.e.

1. Forest
2. Agricultural land
3. Built-up Area
4. Baren Land
5. Water Bodies

Soil texture was achieved by ARC GIS 9.3 Software using clipping tool box from spatial analysis tool box. Here shape file of Rourkela and world soil shape file which was collected from food and agriculture organization of united nation. Digital elevation model (DEM) was generated from topographic map and data uploaded from Arc view, by using Arc GIS 9.3 software the average surface slope has been calculated.

Average width of sub catchment was calculated via equation

$$L=\frac{C\sqrt{A}}{1.128}\left[1-\sqrt{1-\left(\frac{1.128}{C}\right)^2}\right] \quad (1)$$

C= compactness coefficient

A= Area of sub catchment

Compactness coefficient was calculated by equation (2) for sub catchment with compactness coefficient greater than 1.128 otherwise based on user manual of SWMM hydrology unit was divided by the average maximum overland flow length.

$$C=0.282\frac{P}{\sqrt{A}} \quad (2)$$

Where P is the perimeter of the sub catchment in (km)

2.3.2 Hydraulic characteristics

Hydraulic parameter such as stream are determined with the help of GIS, values of parameter such as manning's coefficient, depth of depression storage and conduit roughness for natural channel are obtained from literature. SWMM uses the Manning equation to express the relationship between flow rate (Q), cross sectional area (A), hydraulic radius (R), and slope (S) in all conduits. For standard U.S units.

$$Q=\frac{1.49}{n}AR^{\frac{2}{3}}S^{\frac{1}{2}} \quad (3)$$

Where n is the Manning roughness coefficient. The slope S is interpreted as either the conduit slope or the friction slope (i.e. head loss per unit length), depending on the flow routing method used. For pipe with circular force main crossection either the Hazen-Williams or Darcy-Weisbach formula is used in place of manning's equations for fully pressurized flow. For U.S units the Hazen-Williams formula is

$$Q=1.318CAR^{0.63}S^{0.54} \quad (4)$$

Where C is the Hazen-Williams C-factor which varies inversely with surface roughness and is supplied as one of the cross section's parameter.

2.3.3. Time series

Time series object are used to describe how certain object properties many very with time. Time series can be used to describe how certain object properties may vary with time. Time series can

be used to describe rainfall data. Each time series must be given a unique name and data can be assigning to number of time value data pairs. Time series data can either entered to the program or assessed from a user supplied time series file. For rainfall time series file it is necessary to enter periods with non-zero rainfall amounts. The time series graph obtain during this modeling are given below. The fig.3, fig.4, fig.5, fig.6, fig.7and fig.8 represent that computed graph of precipitation (mm) vs time (hour) in SWMM of year 2002, 2003,2009,2010,2011 and 2015 respectively.

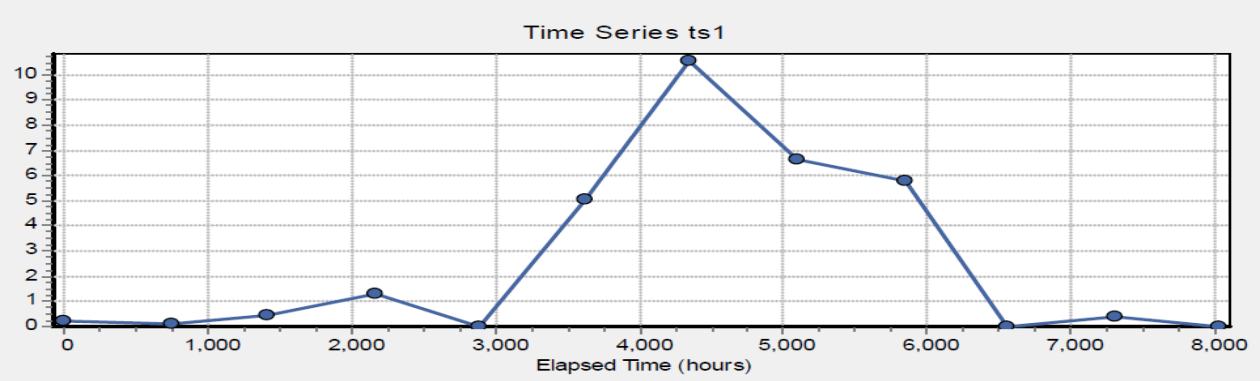


Fig.3:- Computed graph of precipitation (mm) Vs time (hour) in SWMM of year (2002)

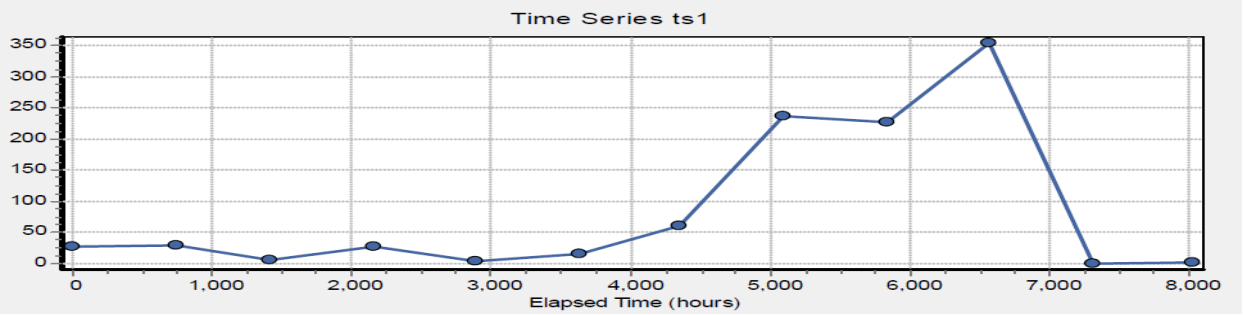


Fig.4:- Computed graph of precipitation (mm) Vs time (hour) in SWMM of year (2003)

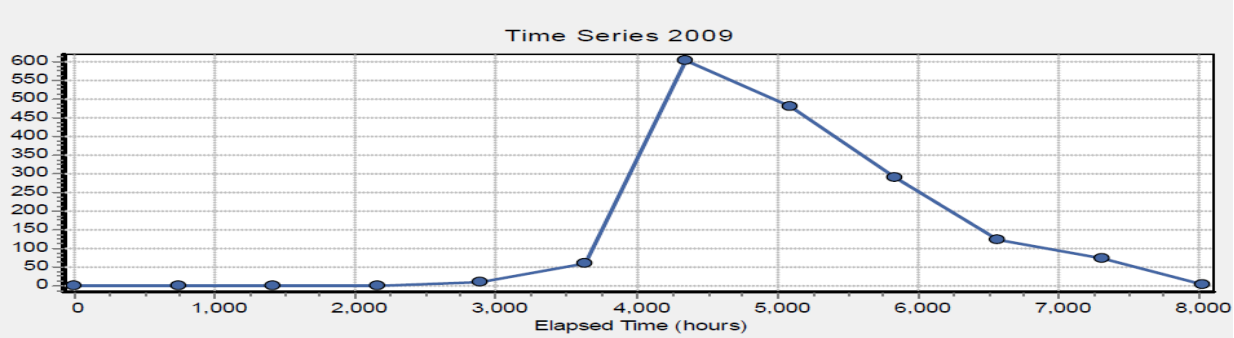


Fig.5:- Computed graph of precipitation (mm) Vs time (hour) in SWMM of year (2009)

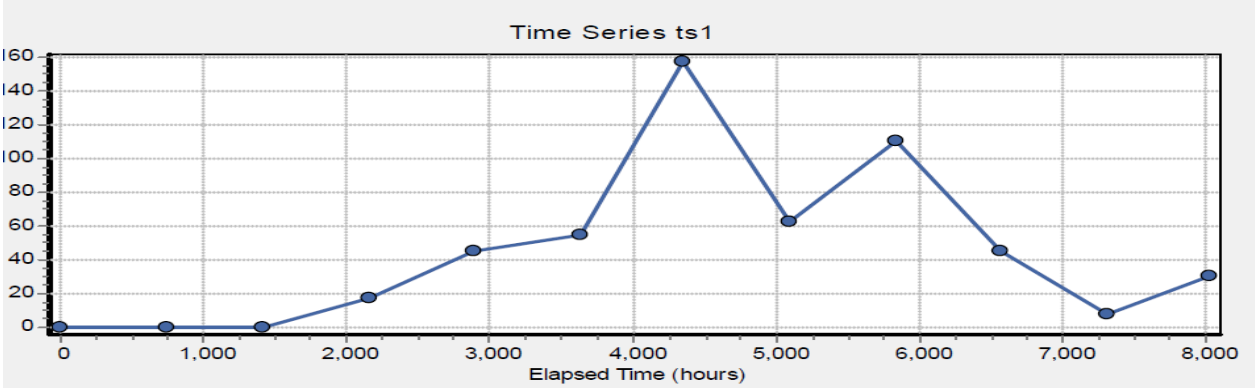


Fig.6:- Computed graph of precipitation (mm) Vs time (hour) in SWMM of year (2010)

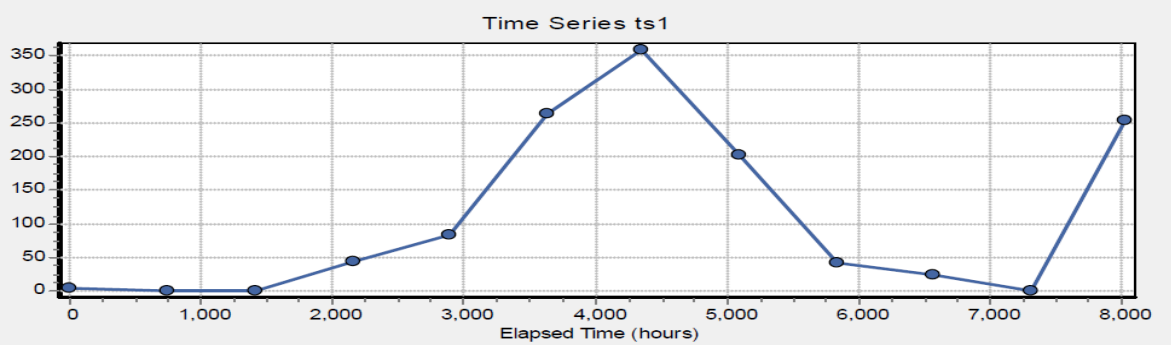


Fig.7:- Computed graph of precipitation (mm) Vs time (hour) in SWMM of year (2011)

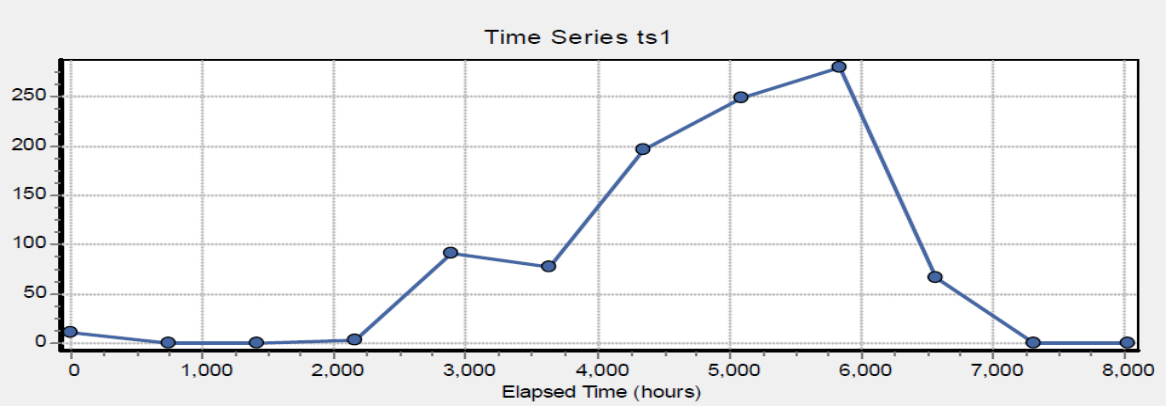


Fig.8:- Computed graph of precipitation (mm) Vs time (hour) in SWMM of year (2015)

3. Results and Discussion

3.1. SCS method for runoff calculation

For model calibration, the land use map of 2002, 2003, 2009, 2010, 2011, 2015 and daily rainfall data for 2002, 2003, 2009, 2010, 2011, 2015were used for simulation. At the alike time runoff calculation was done by using SCS CN curve method. The US Department of Agriculture (USDA) Natural Resources Conservation Service's curve number (CN) method uses data inputs as of daily LULC, rainfall and hydrologic soil group data to calculate direct runoff (Harbor, 1994; Harbor *et al*., 1998; Wang *et al*., 2005; Sun *et al*., 2011). The CN method uses the following equation to compute direct runoff:

$$R = \frac{\left(P - I_a\right)^2}{P - I_a + s} \quad \textbf{(5)}$$

Where, *R* is direct runoff, *P* is the precipitation, I_a is the initial abstraction (initial loss), and *S* is potential maximum retention, or storage capacity a measure of the ability of a division to abstract and retain storm precipitation.

Based on the analysis of the outcome from many small experimental sub catchment, the SCS developed an empirical relationship between I_a and *S* as $I_a = 0.2S$. Therefore, the direct runoff is given as:

$$R = \frac{\left(P - 0.2S\right)^2}{P + 0.8S} \quad \textbf{(6)}$$

The maximum retention (S) is determined using the following equation (SI system):

$$S = \frac{25400 - 254CN}{CN} \quad \textbf{(7)}$$

Where, CN is the curve number, which is an index that represents the muddle of, land use classes, hydrologic soil group and antecedent moisture circumstances. The values of CN can be obtained for different land uses, soil groups, and antecedent hydrologic conditions from the standard table provided by SCS-USA (NRCS, 1986) in manual.to estimate annual direct runoff using daily rainfall data for the period of 2002 - 2015 with different LULC maps of 2002, 2003, 2009, 2010, 2011, and 2015 In order to analyze hydrological effects of urbanization, the urbanization scenarios were built by overlaying each impervious surface to the land use map of these years, producing urbanization scenarios for 2002, 2003, 2009, 2010, 2011 respectively. That way, the hydrologic effect of urbanization could be assessed, avoiding the effects caused by all other land use changes. The changes in direct runoff with different urbanization scenarios were analyzed, and the relationship between annual direct runoff and the impervious surface area was investigated. In SCS CN Curve method, the land use map of 2002 and daily rainfall data for 2002 were used for 2002 simulation; the land use data for 2003 and daily rainfall data for 2003 were used for 2003 simulation; and the land use data for 2009 and daily rainfall data for 2009 were used for 2009 simulation.

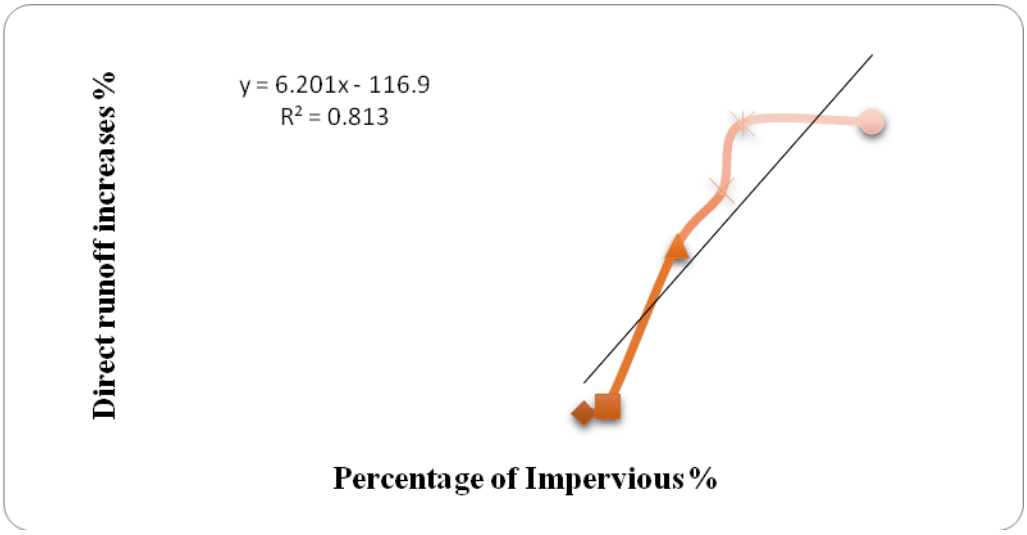


Fig.9:-The linear relationship between average annual direct runoff increases and the impervious surface area (%)

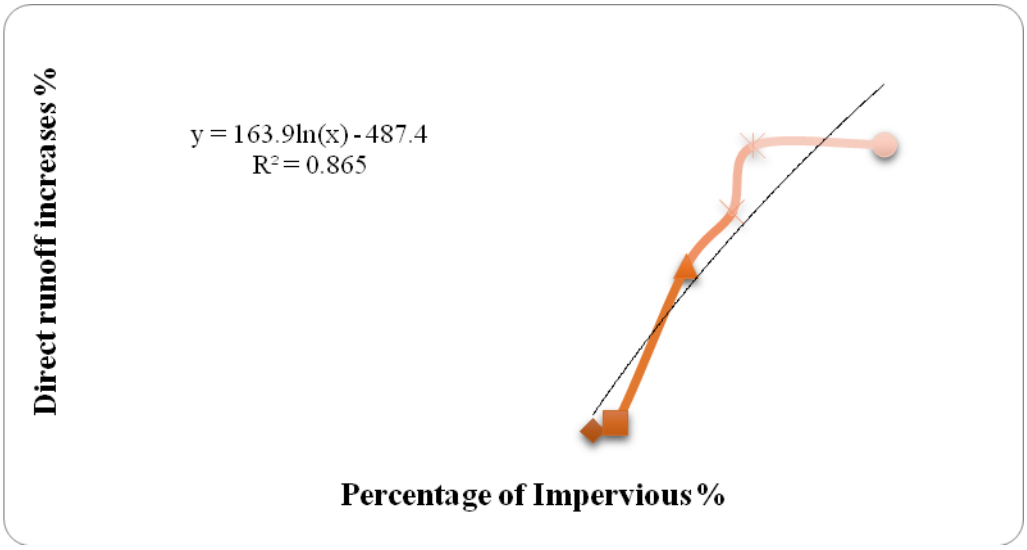


Fig.10:-The logistic relationship between average annual direct runoff increases and the impervious surface area (%)

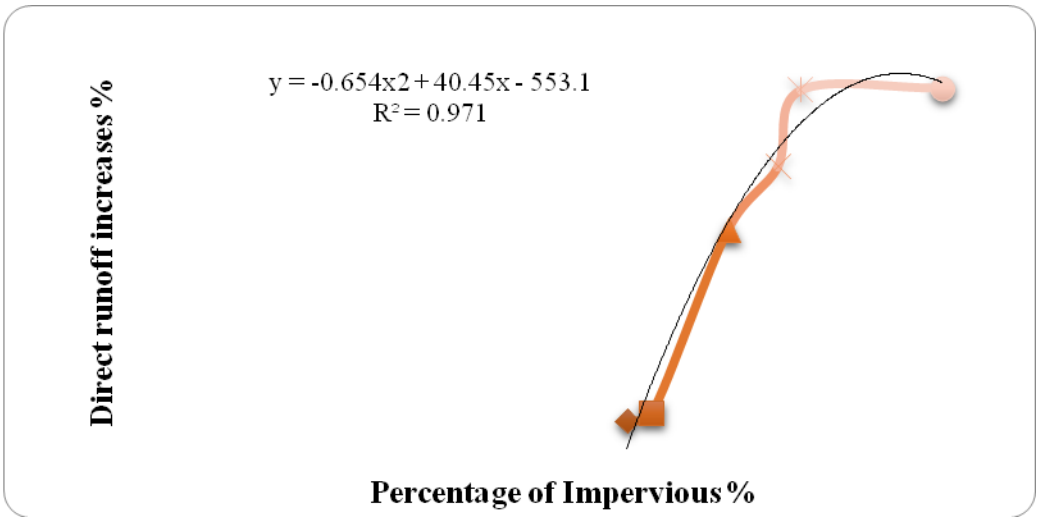


Fig. 11:-The binomial relationship between average annual direct runoff increases and the impervious surface area (%).

Figure-11 shows the relationship between average annual direct runoff percentage increase and the percentage of impervious surface area. Strong and positive binomial relationships (R^2 = 0.971) were observed between runoff percentage increase and impervious surface area, though there was a good logistic relationship between them (R^2 = 0.865)(Figure-10), but linear relationships were more preferred, figure-9 shows that there was two types linear relationships between runoff percentage increase and impervious surface area, when impervious area is less than 9.0%, the direct runoff will increase linearly with the impervious area (R^2 =0.813), however, when impervious area is great than 9.0%, the direct runoff will also increase linearly with the impervious area(R^2 = 1.00), but at much lower rate. The results indicated that the annual direct runoff increase was highly correlated with increasing impervious surface area, which is in agreement with those from Bhaduri *et al*. (2001) and Sun *et al*. (2011), who both applied SWMM model to predict a linear relationship between average annual runoff and increasing imperviousness.

4. Conclusions

The land cover (Built-up Area) change caused due to different activities in Rourkela City and its surroundings. For this purpose, 6 digital images are used for the years 2002, 2003, 2009, 2010, 2011, and 2015. These images are analyzed using the data processing techniques in ArcGIS software – Arc Map 10.1. Remote sensing can provide a better picture of monitoring land use and land cover changes. These maps revealed that the watershed experienced conversion of approximately 16% non-urban area to urban area between 2002 and 2015. The Storm Water Management Model (SWMM) was used to calculate direct runoff generation. The model was repeatedly run with different urbanization scenarios to investigate the hydrological response to land use changes. The simulation results of SWMM model for the various urbanization scenarios indicate that when the impervious surface area changed from 21.05% of 2002 scenario to 32.56% of 2009 scenario, the average annual direct runoff depth would increase from 988.26 mm to 1881.71 mm. The results also indicate that the annual direct runoff depth is highly correlated

with the percentage of impervious surface area. When impervious surface area is less than 25%, the annual direct runoff depth will increase linearly with impervious surface area (R^2 =0.86); however, when impervious surface area is greater than 25%, the annual direct runoff depth will also increase linearly with impervious surface area (R^2 = 0.81) but at much lower rate.

5. Acknowledgements

The author wish to acknowledge thankfully the support from the Institute and by the second authors for carrying out the research work in the ArcGIS Laboratory at National Institute of Technology, Rourkela is thankfully acknowledged.

6. References

Arnold.et.al. (1998), "Large-area hydrologic modeling and assessment: Part I. Model development", Journal of American Water Resources Association, 34: 73–89.

Bhaduri.et.al. (2001), "Long-term hydrologic impact of urbanization: a tale of two models", J. Water Resource. Plan. Manage. 127(1): 13–19.

Choi K and Ball JE**. (2002**)," complexity of land use, population and socio-economic activities in urban area, storm water management is a complex task", Urban Water 4, 31-41.

Cibin R.et.al. (2010), "Sensitivity and identifiability of stream flow generation parameters of the SWAT model". Hydrological process, Hydrology. Process 24, 1133-1148.

Harbor.et.al. (1998), "Long-term hydrologic impact assessment (L-THIA) GIS", Public Works, 129:52–54.

Harbor, J. M., M. Grove, B. Bhaduri, and M. Minner, 1998, "Long-term hydrologic impact assessment (L-THIA) GIS", Public Works, 129:52–54.

Rossman LA. (2009) analyzed **"**SWMM is a mathematical model that originally developed for urban runoff quantity and quality simulation in storm and combined sewer systems for single or continuous events of runoff", version 5.0, EPA. United States 233 P.

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

(An Institute under Ministry of HRD, Govt. of India, New Delhi)
Ashok Rajpath, Patna – 800005

Dr. Ramakar Jha
Chair Professor & Head
Department of Civil Engineering

Email: rj@nitp.ac.in, rjha43@gmail.com
Tel.: +91 0612 269130 (Ext) 122(O)
Web site: www.nitp.ac.in

To,

Dear **Swagatika Biswal, Dr. Bandita Naik, and Dr. K. K. Khatua**

Subject: (a) Acceptance of Research Paper for ORAL Presentation
(b) Submission of Registration Fee for its publication in Proceedings

Ref.: Paper No. 444 (RAINFALL RUNOFF STUDIES OF BRAHMANI RIVER BASIN USING)

It is my pleasure to inform you that your above referred research paper has been accepted for ORAL PRESENTATION in the very prestigious International Conference HYDRO-2018-INTERNATIONAL.

You are requested to kindly make online payment of Registration Fee for at least one Author and Co-authors attending the Conference and send the duly filled Registration Form by 25th October 2018. **The research papers are likely to be published in the Proceedings (Springer) only after the receipt of registration fee from the author.** E-poster Template is attached too.

Looking forward to see you in HYDRO 2018 International at NIT Patna.

With kind regards,

(PROF. (DR.) RAMAKAR JHA)

Chair, HYDRO-2018-INTERNATIONAL

hydro2018international@gmail.com

RAINFALL RUNOFF STUDIES OF BRAHMANI RIVER BASIEN USING ANN

Swagatika Biswal[1], Bandita Naik[2], K. K. Khatua[3]

[1]M.Tech Student, Department of Civil Engineering, CAPGS, BPUT, Rourkela, India
[2]Facuity in Department of Civil Engineering,CAPGS, BPUT, Rourkela,India
[3]Associate Professor in Department of Civil Engineering, NIT, Rourkela,India
Email: swagatikabiswal9@gmail.com
Telephone/MobileNo: +7008561765

Abstract

Rainfall-runoff is a very complicated process due to its nonlinear and multidimensional dynamics, hence it difficult to model. There are various methods for time series based on the model to rainfall and runoff. In the present study, Feed-Forward Back Propagation & Auto-Regressive Integrated Moving Average models are applied to predict monthly runoff in Brahmani River of the three stations Jaraikela, Jenapur, and Tiliga. ANN with different transfer function like *TANSIG* and *PURELIN* is used to find runoff prediction in these areas. Different statistical error analysis is done, to known the better transfer function. From the observation, it was concluded that transfer function is given the better result than *PURELIN*. The predicted runoff found by *TANSIG* transfer function was again compared with ARIMA model. From the statistical error analysis, it was observed that ANN was given the better result than ARIMA method.

*Keywords: tansig, purelin, ann, a*rima*, feed forward back propagation*

1. INTRODUCTION

Many natural resources available on the earth, water is one of them most important natural resources. Without water life cannot be imagine on the earth surface. 71% of the Earth's surface is water- covered, and the oceans hold about 96.5% of all Earth's water. Water also exists in the air as water vapors, in rivers and lakes, in icecaps and glaciers, in the ground as soil moisture and in aquifers (Ref water.usgs.gov). But the problem is that water is not available at proper place at proper time. Water is not constant. It always moves on one place to another place. Water of the different catchment area always changes from one state to another under the effect of solar radiation. Water surface converted to vapor by evaporation due to solar heat radiation. The vapor goes too continuously atmosphere, then it contain due to sudden fall of temp & pressure by this process clouds will be formed then precipitation occurs. Some vapors converted into ice at peak of the mountain. These Ices again melt in summer duration & flow as river to meet the sea or ocean. These processes of evaporation, precipitation & melting of Ice go on continuously like an endless chain thus balance is maintain in atmosphere. This phenomenon is known as hydrology cycle. Rainfall is the major component of hydrology cycle & runoff is the primary sources of this cycle. Rain fall – runoff relationship is one of the most complicated hydrologic phenomena to comprehend due to the tremendous spatial and temporal variability of watershed characteristics and precipitation patterns, and the number of variables involved in the modeling of the physical

processes. Since the 1930s, numerious rainfall- runoff models have been developed to forecast stream flow (A. Sezin Tokar et.al 1999). The ANN models are powerful prediction tool for the relationship between rainfall and runoff. The rain fall runoff relationship is highly non linear, multidimensional, time dependence and spatial varying parameter.

Y. B. Dibike et al. (2001) Two type of ANN network MLP & RBF were using to investigate for downstream flow fore casting in the Apure river basin (Venezula). Those networks were compared with conceptual rainfall-runoff model and were found which one given better for this river flow forecasting. . Rajurkar et al. (2002) stated that a linear MISO model coupled with the ANN was provided a better represented of the rainfall- runoff relationship in such large size catchment compared with linear &non linear MISO models. The presented model provided systematic runoff estimation. Wilby et al. (2003) provided neural network solution to develop for daily discharge series simulated by conceptual rainfall-runoff model, observed daily precipitation total & evaporation rates of the test river basin in south England. Correlation analysis suggests that hidden nodes in the NN correspond to dominant processes within the conceptual model. Rajurkar et al. (2004) modeling daily flows during flood event using ANN. The study uses data from two large size catchments in India and five other catchments used earlier by the World Metrological Organization (WMO) for inter comparisons of the operational hydrological models. ANN proves to be very much useful modeling the rainfall-runoff relationship in the non- updating mode. Yen-Ming Chiang et al. (2004) provided a systematic comparison of two basic types of Neural Network of Static & dynamic method used in Lan-Yang-River of Taiwan. V. K. Somvanshi et al. (2006) was predicting rainfall based past observation using ANN and ARIMA technique. Muhammed aqil et al. (2007) was suggested that recurrent & feed forward network with Levenberg-Marquardt are able to forecast of the catchment flow in advanced with reasonable prediction accuracy Vahid Nourani et al. (2009) Recently ANN as a nonlinear- extrapolator is extensively used by hydrologist for rainfall-runoff modeling as well as other field of hydrology. The model was predicted both short & long term runoff discharges of using multi-scale series of rainfall & runoff data as the ANN input layer. Ghumman et al. (2012) compared ANN model with a mathematical conceptual model. An ANN model is an important alternative to a conceptual models & it was used when the range of collected data set is short and data is of low standard. Ghose et al. (2013) predict runoff used Non-Linear Multiple Regression (NLMR) & Adaptive Neuro-Fuzzy Inference system (ANFIS). Mohammad Valipur et al. (2013) observed that ARIMA model had a less error comparing with the ARMA model of Dez dam reservoir in 12 past months. Elsafi. 2014 used ANN model to forecast flooding along the river Nile. This work was provided baseline information toward the establishment of a flood warning system certain section of the river. Farajzaden et al. (2014) was observed that estimated values of monthly rainfall through FFNN were close to ARIMA model of Urima lake basin. In this paper correlation of rainfall-runoff, prediction of runoff using precipitation, mean temperature, solar, wind, humidity and discharge.ANN with different transfer function used to predict runoff and analyzed with mean absolute deviation, mean square error and root mean square error. Comparing the validation phase of runoff predicted by ANN and ARIMA model use statistical error analysis.

2. STUDY AREA

Brahmani River is the second largest river in Odisha after Mahanadi. Location of Brahmani river basin and study area is shown in Figure 1 and 2 respectively. It is a major seasonal river in the Odisha state of Eastern India. The Brahmani is formed by the confluence of the South Koel River and Sankh River near at the Vedvyas, Panposh in Odisha. The latitude 22°14′45″N and longitude 84°47′02″ E are the geo coordinate of river. At about 480 kilometers long, its constituent rivers are included its length extends to about 799km, of which 541 km are in Odisha. It has a catchment area of about 39,033 square kilometers in Odisha alone. Brahmani river basin has 9 hydro-observation stations. In present study discuss about 3 gauging stations, Jenapur, Jaraikela and Tiliga. These stations belongs districts are Jajpur, Sundargarh and Simdega (Jharkhand). Jaraikela and Tiliga located on the tributary river Koel and Sankh. The Sankh River and south Koel River is two major tributary river of Brahmani river basins. The Sankh River and South Koel River has originated Ranchi district of state Jharkhand. The latitude of the south koel river 23°20′N and longitude 85°12′E. The Sankh river latitude 23°14′N and longitude 84°16′E geo coordinate of the river. The total length of the Sankh River is 240 km. The gauging stations Jenapur, Jaraikela and Tiliga drainage area are respectively 33955, 9160 and 3160 sqkm.

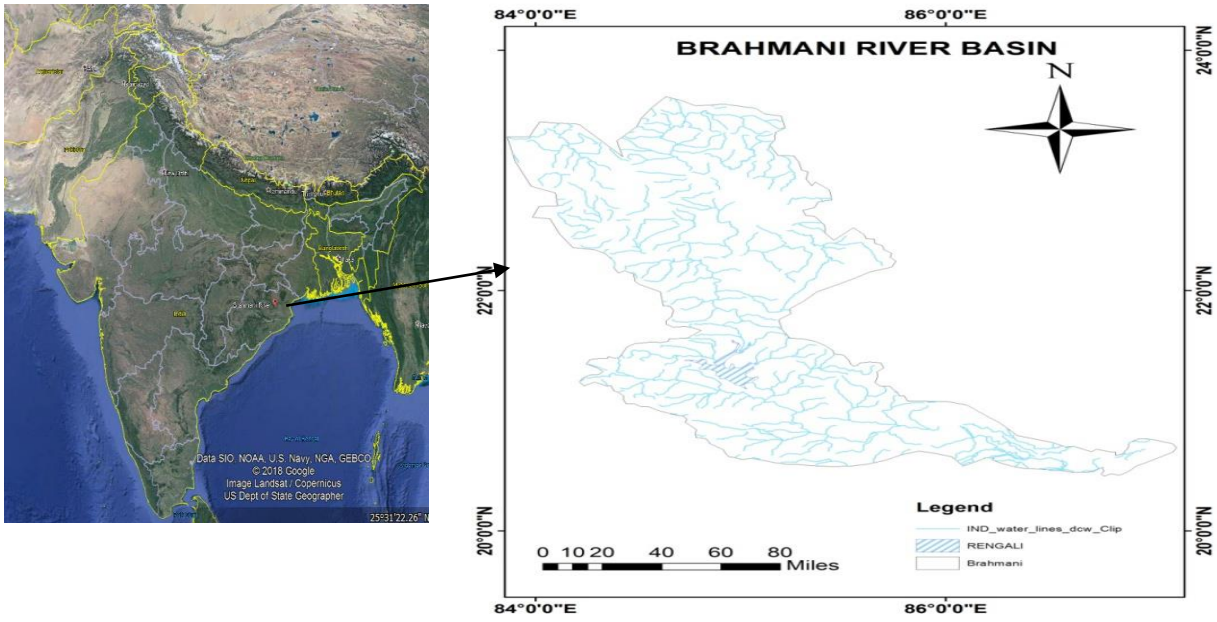


Figure 1. Location of Brahmani river basin

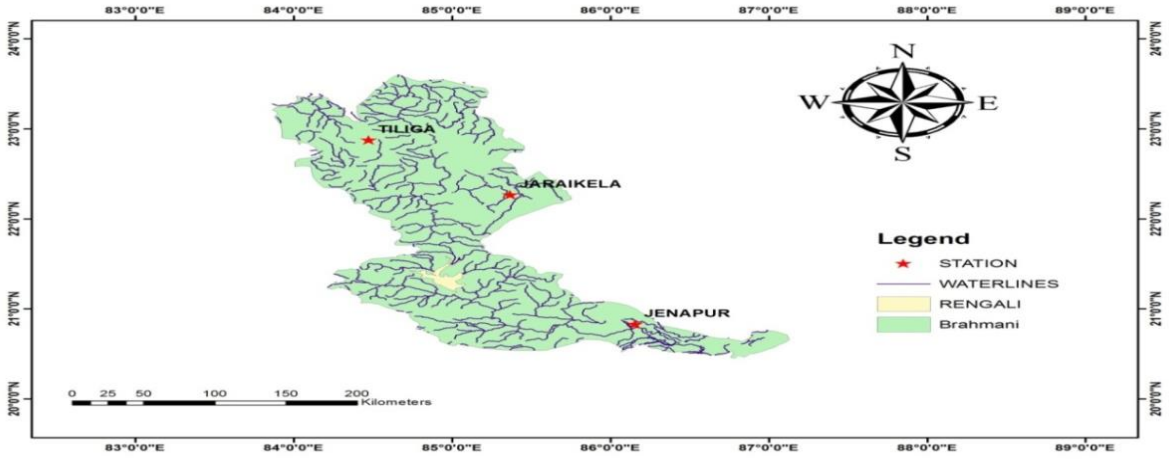


Figure 2. Location of study area

3. METHODOLOGY

3.1 Feed forward back propagation neural network

In this study feed forward back propagation neural network is propagated in one direction from input layer to output layer. The MLP networks can more than one hidden layer. The feed forward network that has interconnected nodes arranged into three layer input layer, hidden layer and output layer. In this study five number input layer, one output layer and 10 hidden layers are used in multilayer feed forward back propagation algorithm to predict river basin runoff. Five input variables, temperature, solar, wind, humidity and precipitation. The input nodes pass on the input signal values to the nodes depending on the connection weight between the input nodes & hidden nodes. Connection between weight and hidden nodes are inter connection link between the successive layer each neuron in a certain layer is connected to every single neuron to the next layer and adjustable connection weight. This network have used for training purpose Levenberg-Marquardt back propagation (LMBP) algorithm because this technique is more effective than conventional gradient techniques.

$$X_{K+1} = [X_K - J^T J + \mu I]^{-1} J^T e \qquad \text{Equation (1)}$$

Where X is the indicate the weight of under neural network and μ scalar control the learning process. J is the Jacobian matrix; 'e' is the vector of network.

In this present study two type of transfer function have to be used Tansig and Purelin.The tansig transfer function, hyperbolic tangent (tanh) is a symmetric s-shaped (sigmoid) function whose put lies in the range [-1, 1] with the identify function the activation neuron is passed on directly as the output of the neuron & output lies in the range [∞.-∞].Purelin is the linear function values between [-1,1].Function of linear activation function is f(x) =x.

3.2 Auto Regressive Integrated Moving Average (ARIMA)

Time series model such as Auto Regressive Intigrated Moving Average (ARIMA) are widely used for hydrological time series forecasting. They are basically linear model assuming the data the data are stationary and have limited ability to capability non stationarities & non-liearities in hydrologic data. It has basically three parts moving average and differencing process.In general auto regressive(AR) moving average (MA),auto regressive moving average (ARMA) & auto regressive integrated moving average (ARIMA) model are applied to time series .Therefore, when the process is non-stationary series before conducting a modeling process .In an ARIMA model the futher value of a variable is supposed to be a linear combination of past values and past errors which can be expressed as in the eq (2)

Yt= $\theta_0 + \emptyset_1 y_{t-1} + \emptyset_2 y_{t-1} + \cdots\cdots\cdots\cdots + \emptyset y_{t-p} + \cdots\cdots\cdots\cdots +$

$\epsilon_t - \theta_1 \epsilon_{t-1} - \theta_2 \epsilon_{t-2} - \cdots\cdots\cdots \quad - \theta_q \epsilon_{t-q} \cdots\cdots\cdots$

Equation (2)

Where $\theta_{j,} \emptyset_J$ are coefficients ,Y_t is the actual value at time *'t'*

P and *q* are the Auto regressive and moving average coefficients.

3.3 Evaluation criteria

The model is to obtained both statistical and graphical criteria. Statistical model criteria consist mean absolute deviation, mean square error and root mean square error.

Where MAD = $\sum_{i=1}^{n} [Q_i - \hat{Q}_i]$ Equation 3

MSE = $\sum_{i=1}^{n} [Q_i - \hat{Q}_i]^2$ Equation 4

RMSE= $\frac{\sqrt{\sum_{i=1}^{n} [Q_i - \hat{Q}_i]^2}}{n}$ Equation 5

The above equation Q_i is the observed value. $\hat{Q}_i$ is the predicted value and 'n' is the total number of observed sample.

3.4 ANN model development for prediction runoff

ANN model use in three station Jaraikela, Jenapur and Tiliga for runoff modelling using MLP feed forward back propagation network. Solar, wind, temperature,humidity and precipitations are taken into input parameter and discharge is taken output parameter. Monthly weather data are collected from 1990 to 2014 are collected from `http://swat.tamu.edu for each station. Out of 295 sample data 70% are use for training phase, 15% use for testing phase & 15% use for validation phase. For training phase minimize error, testing and validation phase properly training. The

weather data set in the present study input variables as well as target variable are first normalised for the activation function using the equation.

$$\bar{x} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

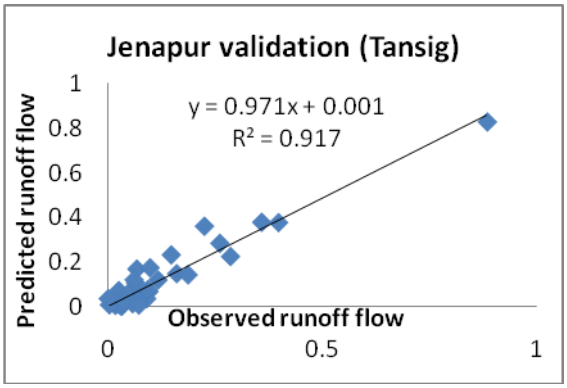
Where $\bar{x}$ is the standardized value of the input, x_{min} and x_{max} are respectively the minimum & maximum of the actual values in all observation & x is the original data set The main reason of the standardizing the data matrix is input variables have measured in different unit, recasting then in dimensionless unit.The graphical performance indicator give better result when the data pair are closing to 45° line and good super position between the desired and calculated flow values in the training ,testing and validation. The activation function changed in second layer because hidden layer to represent the output layer.

4. RESULT AND DISCUSSION

The validation phase 15% data should be used.The main aim of the validation phase using twotype of transfer function Tansig and Purelin properly trained, after trained validation phase, stastical error calculation is done for knowing which transfer function is given better perfermance.Table 1, Table 2 and Table 3 shows the statistical error ananlysis of three station using different activation function.

Table1. Comparision stastical analysis is done of using two transfer function of ANN at Jenapur of validation phase.

	Stastical analysis	TANSIG	PURELIN
JENAPUR	MAD	0.033	0.032
	MSE	0.001	0.003
	RMSE	0.043	0.565
	R^2	0.917	0.866



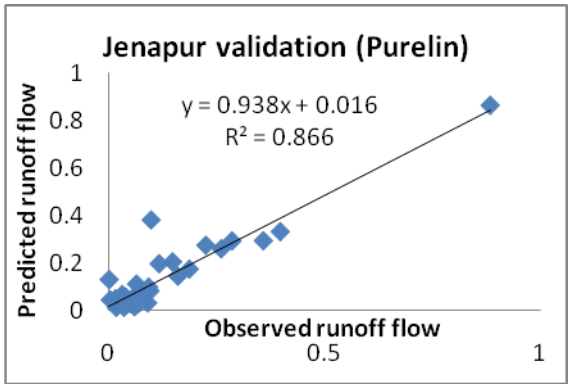


Figure 3 Cofficient of determination graph of using Tansig and Purelin transfer function at Jenapur.

Table 2. Comparision stastical analysis is done of using two transfer function of ANN at Jaraikela of validation phase.

JARAIKEL	Stastical analysis	TANSIG	PURELIN
	MAD	0.056	0.045
	MSE	0.006	0.006
	RMSE	0.080	0.088
	R^2	0.734	0.681

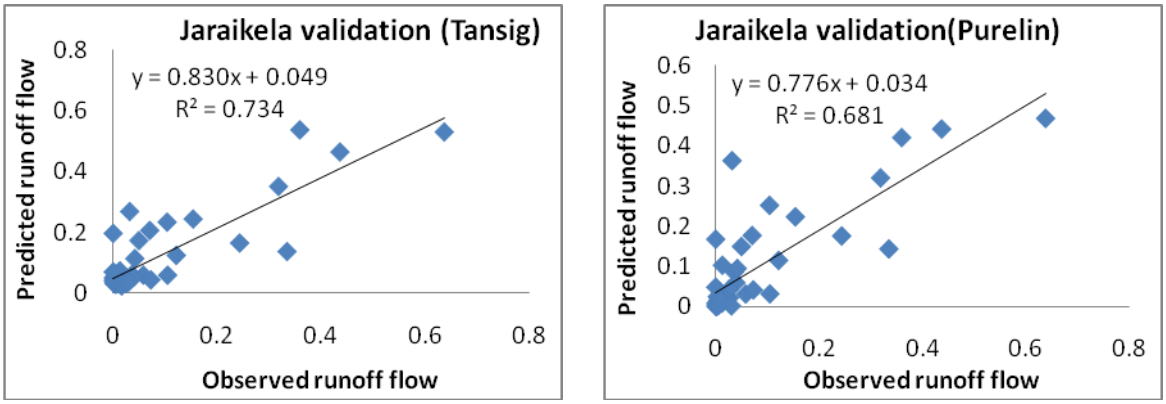


Figure 4 Cofficient of determination graph of using Tansig and Purelin transfer function at Jaraikela.

Table 3. Comparision stastical analysis is done of using two transfer function of ANN at Tiliga of validation phase.

TILIGA	Stastical analysis	TANSIG	PURELIN
	MAD	0.034	0,034
	MSE	0.003	0.004
	RMSE	0.058	0.065
	R^2	0.920	0.915

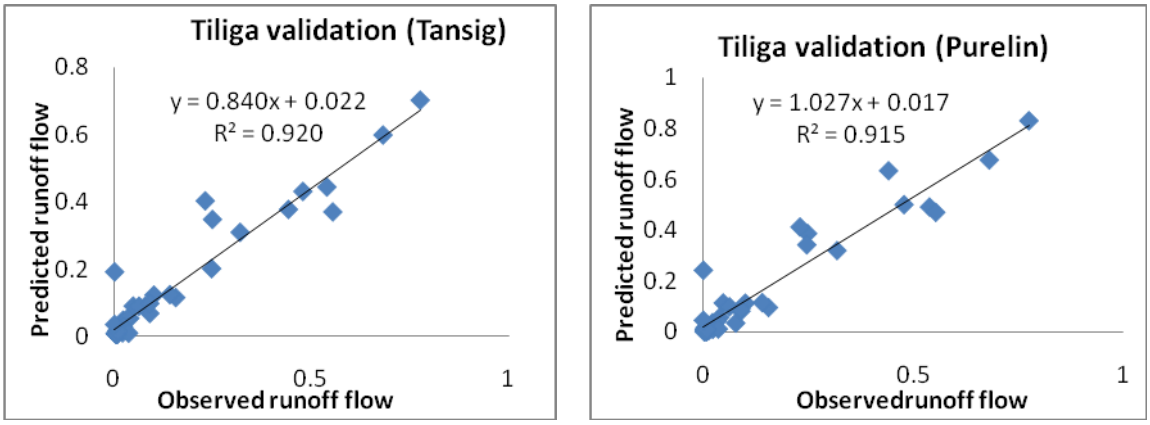


Figure 5 Cofficient of determination graph of using Tansig and Purelin transfer function at Tiliga.

The performance measure of ANN models in terms of numerical computation are MAD, MSE, RMSE and R^2 shown in Table-1, Table-2 and Table-3. On the above table it is observed that Tansig function is given better result according to Purelin.

4.1 Comparison graph of ANN model and ARIMA model

The predicted runoff by used ARIMA method and it is again comparing with the best transfer function of ANN found by the observation as shown in Figure-7, Figure-8 and Figure-9. Performance evaluation statistics ANN and Time series model at different station.

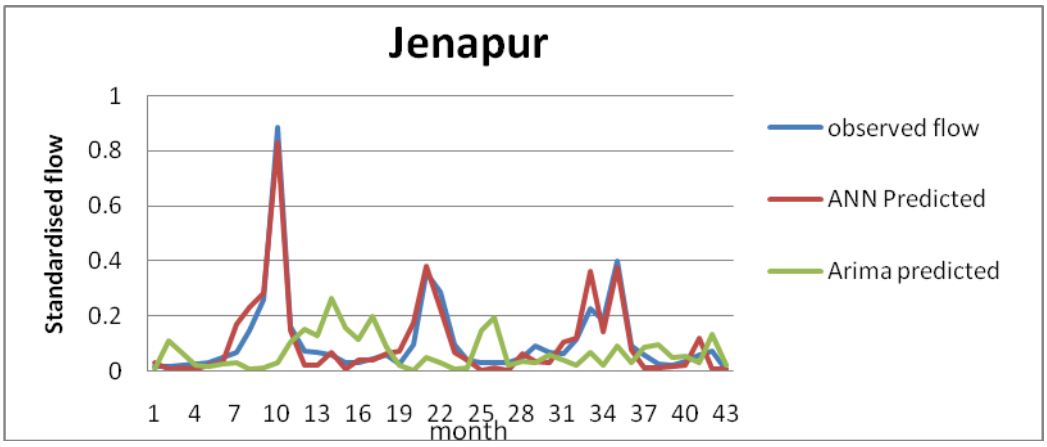


Figure 6. Comparison graph of ANN and ARIMA predicted flow of Jenapur

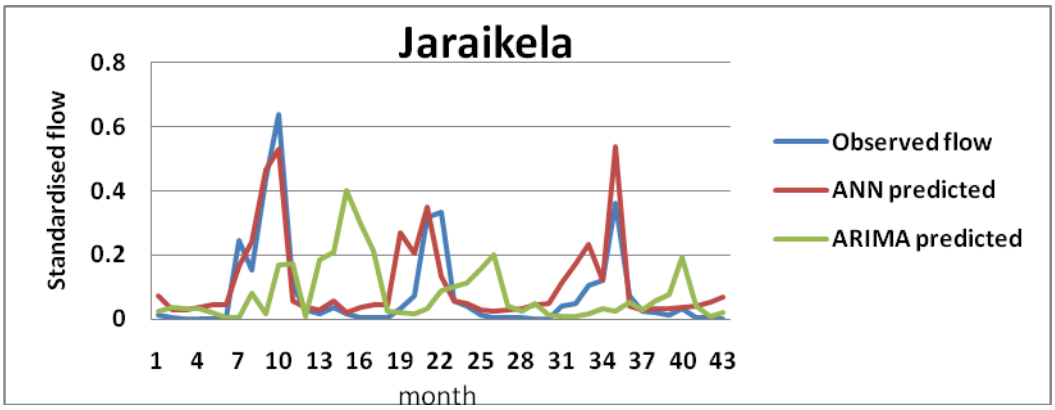
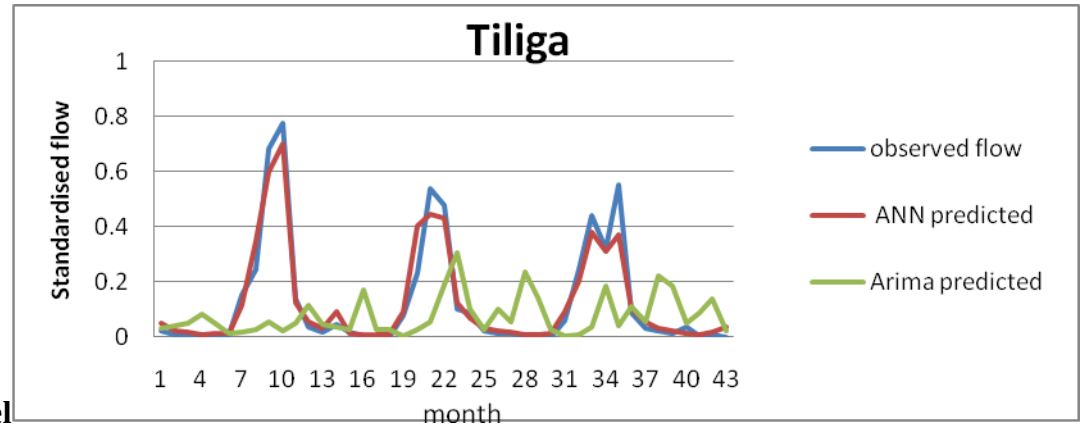


Figure 7 .Comparison graph of ANN and ARIMA predicted flow of



Jaraikel

Figure 9. Comparison graph of ANN and ARIMA predicted flow of Tiliga

Table 4. Comparison statically analysis ANN and Time series model at different Gauging stations.

STATIONS	TECHNIQUES	MAD	MSE	RMSE
Jenapur	ARIMA	0.104	0.030	0.175
	ANN	0.033	0.001	0.043
Jaraikela	ARIMA	0.110	0.027	0.166
	ANN	0.053	0.005	0.005
Tiliga	ARIMA	0.142	0.050	0.224
	ANN	0.030	0.002	0.051

The performance measure of ANN and ARIMA models in terms of numerical computations are shown in table 4.The table indicates that the ANN model outperforms the ARIMA model. The MAD error for model data set of Jenapur, Jaraikela, and Tiliga for ARIMA model is 0.104, 0.110

and 0.142 while the same error measure is considerably lower at 0.033, 0.053 and 0.030 in ANN method. The other performance measures such as MSE at, Jenapur, Jaraikela and Tiliga for ARIMA models are 0.030, 0.027 and 0.050 but in same error measure is considerably lower at 0.001, 0.005 and 0.002 in ANN. The RMSE values of, Jenapur, Jaraikela and Tiliga in ANN models are 0.043, 0.005 and 0.051which are lower than 0.175, 0.166 and 0.224. On the basis error calculation of MAD, MSE and RMSE the ANN model is more appropriate than ARIMA model. In our study observed that ANN model should be appropriate prediction tool for predicts rainfall according to ARIMA model

5. CONCLUSION

Highly nonlinear multidimensional natural recorded parameter of rainfall-runoff studies using ANN and ARIMA techniques. 2010 December to 2014 July recorded data solar, wind humidity, temperature, precipitation and runoff data was used for validation model or predict runoff. ARIMA method use runoff data of past observation as input to neural network. For present analysis uses 5 types of past observation data and one output data that is runoff which was used to ANN. On this study concluded that ANN model is used to an appropriate model for prediction runoff, than performance of ARIMA model.

6. REFERENCES

Aqil, M., Kita, I., Yano, A., & Nishiyama, S. (2007). Neural networks for real time catchment flow modeling and prediction. *Water Resources Management*, *21*(10), 1781-1796.

Chiang, Y. M., Chang, L. C., & Chang, F. J. (2004). Comparison of static-feedforward and dynamic-feedback neural networks for rainfall–runoff modeling. *Journal of hydrology*, *290*(3-4), 297-311.

Dibike, Y. B., & Solomatine, D. P. (2001). River flow forecasting using artificial neural networks. *Physics and Chemistry of the Earth, Part B: Hydrology, Oceans and Atmosphere*, *26*(1), 1-7

Elsafi, S. H. (2014). Artificial neural networks (ANNs) for flood forecasting at Dongola Station in the River Nile, Sudan. *Alexandria Engineering Journal*, *53*(3), 655-662.

Farajzadeh, J., Fard, A. F., & Lotfi, S. (2014). Modeling of monthly rainfall and runoff of Urmia lake basin using "feed-forward neural network" and "time series analysis" model. *Water Resources and Industry*, *7*, 38-48

Ghose, D. K., Panda, S. S., & Swain, P. C. (2013). Prediction and optimization of runoff via ANFIS and GA. *Alexandria Engineering Journal*, *52*(2), 209-220.

Ghumman, A. R., Ghazaw, Y. M., Sohail, A. R., & Watanabe, K. (2011). Runoff forecasting by artificial neural network and conventional model. *Alexandria Engineering Journal*, *50*(4), 345-350.

Nourani, V., Komasi, M., & Mano, A. (2009). A multivariate ANN-wavelet approach for rainfall–runoff modeling. *Water resources management*, *23*(14), 2877.

Rajurkar, M. P., Kothyari, U. C., & Chaube, U. C. (2002). Artificial neural networks for daily rainfall—runoff modelling. *Hydrological Sciences Journal*, *47*(6), 865-877.

Rajurkar, M. P., Kothyari, U. C., & Chaube, U. C. (2004). Modeling of the daily rainfall-runoff relationship with artificial neural network. *Journal of Hydrology*, *285*(1-4), 96-113

Somvanshi, V. K., Pandey, O. P., Agrawal, P. K., Kalanker, N. V., Prakash, M. R., & Chand, R. (2006). Modeling and prediction of rainfall using artificial neural network and ARIMA techniques. *J. Ind. Geophys. Union*, *10*(2), 141-151.

Tokar, A. S., & Johnson, P. A. (1999). Rainfall-runoff modeling using artificial neural networks. *Journal of Hydrologic Engineering*, *4*(3), 232-239.

Valipour, M., Banihabib, M. E., & Behbahani, S. M. R. (2013). Comparison of the ARMA, ARIMA, and the autoregressive artificial neural network models in forecasting the monthly inflow of Dez dam reservoir. *Journal of hydrology*, *476*, 433-441.

Wilby, R. L., Abrahart, R. J., & Dawson, C. W. (2003). Detection of conceptual model rainfall—runoff processes inside an artificial neural network. *Hydrological Sciences Journal*, *48*(2), 163-181

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
(An Institute under Ministry of HRD, Govt. of India, New Delhi)
Ashok Rajpath, Patna – 800005

Dr. Ramakar Jha
Chair Professor & Head
Department of Civil Engineering

Email: rj@nitp.ac.in, rjha43@gmail.com
Tel.: +91 0612 269130 (Ext) 122(O)
Web site: www.nitp.ac.in

To,

Dear **Arunima priyadarsini patnaik, and Dr. Bandita Naik**

Subject: (a) Acceptance of Research Paper for ORAL Presentation
(b) Submission of Registration Fee for its publication in Proceedings

Ref.: Paper No. 446 (Impact of Climate Change on Hydrological Parameters)

It is my pleasure to inform you that your above referred research paper has been accepted for ORAL PRESENTATION in the very prestigious International Conference HYDRO-2018-INTERNATIONAL.

You are requested to kindly make online payment of Registration Fee for at least one Author and Co-authors attending the Conference and send the duly filled Registration Form by 25th October 2018. **The research papers are likely to be published in the Proceedings (Springer) only after the receipt of registration fee from the author.** E-poster Template is attached too.

Looking forward to see you in HYDRO 2018 International at NIT Patna.

With kind regards,

(PROF. (DR.) RAMAKAR JHA)

Chair, HYDRO-2018-INTERNATIONAL

hydro2018international@gmail.com

Impact of Climate Change on Hydrological Parameters

Arunima priyadarsini patnaik[1], Bandita naik[2]

[1]Department of civil engineering, student, CAPGS, BPUT Rourkela
[2]Department of civil engineering, faculty, CAPGS, BPUT Rourkela
Email: arunima.patnaik@gmail.com
Telephone/Mobile No.: +918455088449

1. Abstract

The increasing rate of global surface temperature is going to have significant impact on local hydrological regimes and thus on water resources, this leads to the assessment of water resources potential resulting from the climate change impacts. Main parameters that are closely related to the climate change are temperature, precipitation and runoff. Therefore, there is a growing need for an integrated analysis that can quantify the impacts of climate change on various aspects of water resources. Quantifying the impacts of land use change and land cover practices on the hydrological response of a watershed has been an area of interest for the hydrologists in recent years as this information could serve as a basis for developing sound watershed management interventions. The degree and type of land cover influences the rate of infiltration, runoff, and consequently the volumes of surface runoff and total sediment loads transported from a watershed. It often results in significant degradation of land resources such as loss of soil by erosion, nutrient leaching and organic matter depletion. However very few studies in India, have used the physically based hydrological models along with the land use / land cover change conditions. Hence in this current work SWAT model has been used to assess the impact of LU/LC changes on daily and monthly streamflow of Mahanadi River Basin of Sambalpur region. The results of the study indicated that the though land use patterns have changed resulting in increase in agricultural, barren and buildup land and decrease in forest cover leading to increase in runoff but changes have not occurred as significantly as the changes in annual stream flow. However the number of days of high intensity rainfall has increased over decade which along with the land use changes explains for the increase in stream flow.

Keywords: *SWAT model, LU/LC changes, daily and monthly runoff*

2. Introduction

2.1 General

Water is the foremost part of all living things, and a major force constantly shaping the human lives on the earth. It is also a key factor in air conditioning of the earth for human existence and in influence the progress of civilization. Among all natural resources water is one of the most important and significant resource found on earth. The redistribution of water through hydrological cycle is also responsible for climate of any place, like daily fluctuations of temperature, precipitation and wind speed and these type of changes in ecosystem affect the hydrological cycle. Over the last 100 years, Odisha is facing an extreme weather condition in the form of natural disasters (flood, drought, heat waves, earthquakes and cyclones). The natural calamities affected 25 of 30 districts of Odisha which results in damages, loss of properties and loss in human lives. Therefore is a necessity to study the impact of climate change on water resource in this region. Increase or decrease in

precipitation pattern can result in increase of frequency of flood, droughts and change in water quality. Therefore, it is necessary to carry out analysis to find out calibration and validation of two climatic parameter i.e. temperature and precipitation.

The National Water policy of India (2002) acknowledges that national perspective are needed to regulate the improvement and management of water resources so that the scarce water resources can be developed and conserved in a balance and environmentally sound basis. Impact of land use changes, watershed development to soil loss and growth of population, water quality and quality is among the most worthy topic in a watershed. The hydrological cycle can be distributed due to changes in land use by the alternating the base flow (Wanga*et al*. 2006) and annual mean discharge of the basin (Costa*et al*. 2003). Hydrological model plays an important role in simulating the process of rainfall-runoff, soil erosion, under different situations. Impact of climate change is going to be most serving in the developing countries due to poor capacity.

A hydrological model SWAT (Soil and Water Assessment Tool) model is used in the present analysis. This model is a physically based, continuous-time model, developed by Dr. Arnold for United USDA-ARS (Agricultural Research Service). SWAT model is used to simulate or predict runoff of different basin, sediment yield and pollution loading in watersheds. The model has an ability to use for small watershed as well as the major river basin systems. It is distributed in time interval hydrological model with an Arc GIS interface. Automated model calibration and validation check. Arnold et al. (2000) applied SWAT with addition of a stream flow filter and recession method for regional estimation of base flow and ground water recharge in the upper Mississippi river basin.

2.2 Study area

Mahanadi River is the sixth largest river in India and one of the major interstate east flowing river in peninsular India. The Mahanadi basin lies between latitude of $19^0 20^{'}$N to $23^0 35^{'}$N and longitude of $80^0 30^{'}$E to $86^0 50^{'}$E.Mahanadi basin is physically surrounded on the north by Central India hills, by the Eastern Ghats in the South and East and by Maikala hill range in the West. The total catchment area of the basin is 141600 sq. km. The river enters in Odisha through Jharsuguda district subsequent to covering about portion of its aggregate length. Before Sambalpur, it meets its tributary Ib. The Ib, which is the third biggest tributary of Mahanadi, ascends in town Pandrapt, Region Raighar (Chhattishgarh) and channels Raigarh region of Chhattisgarh and three district of Odisha, to be specific Sundargarh, Jharsuguda and Sambalpur. After Sambalpur Mahanadi stream take a southerly turn and it is joined by the Ong. The Ong flows towards Sartaipali, Padampur and Bijepur territory of Balangir and Bargarh area of Odisha. Physically, the basin is bounded in the north by the Central India Hills, the Eastern Ghats in the south and east, and the Maikala Hill Range in the west, lying within geographical co-ordinates of 80°30’ E to 86°50’ E and 19°20’N to 23°35’N. Location of study area is shown in Fig-1.

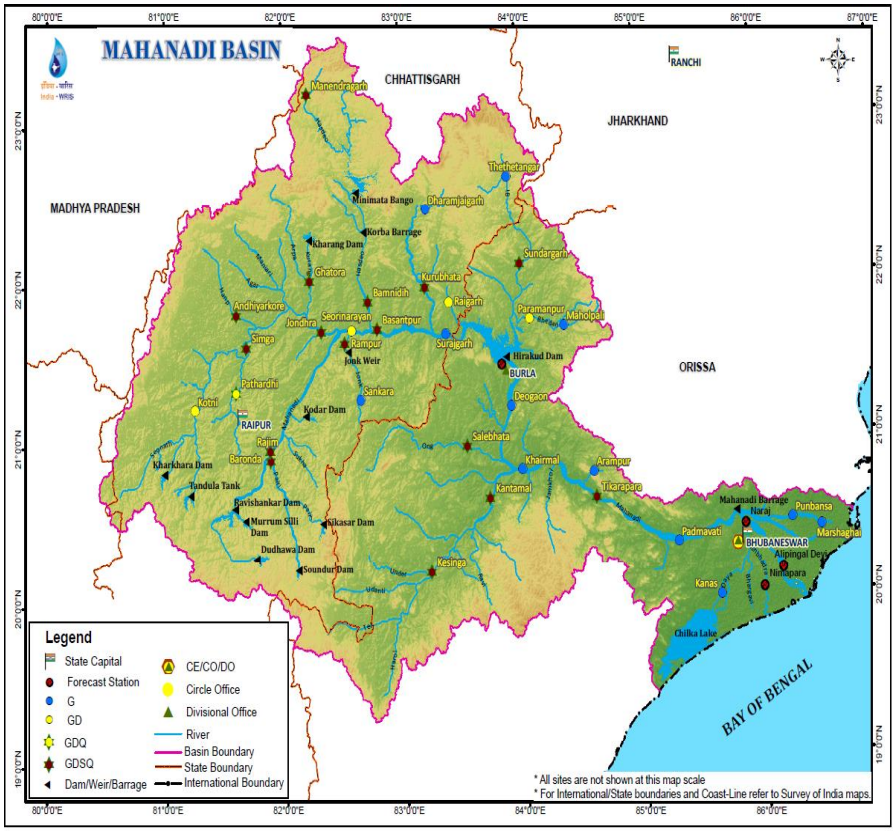


Fig-1: Location of study area (source: India WRIS website)

2.3 Rainfall

Based on the Indian Meteorological Department's (IMD) annual district rainfall figures from 1901–2000, the calculated average rainfall in the Mahanadi basin is 1406 mm. Overall, the Mahanadi basin is a high rainfall region; the lowest annual average being 1080 mm in the Kawardha district of Chhattisgarh, while the Jashpur district of Odisha has the highest annual average rainfall of 1653 mm. The western portion of the basin bordering Maharashtra receives the lowest rainfall. The central part of the basin receives moderate rainfall, while the northern, southern and the delta regions experience the highest rainfall in the basin. Plots the seasonal distribution of rainfall in the basin. Most parts of the basin receives 80–90% of its annual rainfall from the southwest monsoon (i.e. from June to September). However, the amount of rainfall received is dependent on the location in the basin. For example, as compared to the other parts of the basin, the districts located near the delta receive less rainfall (about 60–70% average annual rainfall) between June to September, but receive more rainfall (about 10–22% annual rainfall) from the northeast monsoon (i.e. from October to December). The districts with higher rainfall between October and December also show a marginal increase in the rainfall during March to May as compared to the basin average for this period. Figure 2 shown the Seasonal distribution of rainfall as a percentage of the annual average.

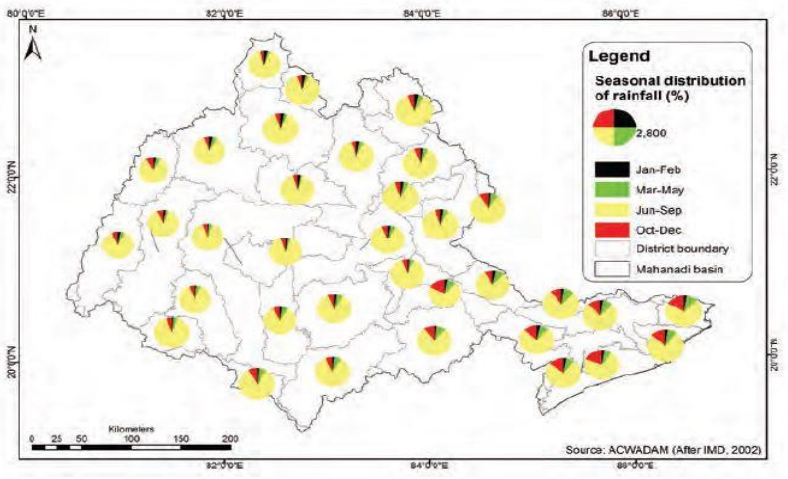


Figure 2: Seasonal distribution of rainfall as a percentage of the annual average

IMD's 100-year district level data was also used to generate trends in the rainfall in the respective districts. Figure 3 shown a map of the linear trends observed on plotting the 112 year (1901–2012) IMD district level data set. Majority of the districts in the basin show a reducing trend computed from the long-term average rainfall. Only two districts each show a constant trend and an increasing trend.

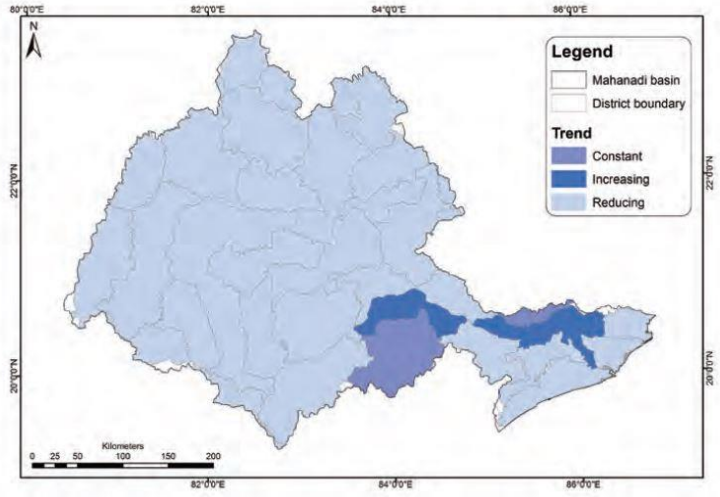


Figure 3: Trends in annual rainfall in the Mahanadi basin
(Source: District level 100 years IMD data)

2.4 Temperature

Daily temperature (maximum, minimum and mean) gridded data (1^0 x $1^{0)}$ for 36 years (1969-2004) collected from IMD has been analyzed. Average monthly temperature variation for 36 years (1969-2004) is given in Figure 4. Three parameters namely minimum, maximum and mean temperature indicates that the December and January are the coldest months with the minimum temperature of 12^0 c. April and May are the hottest months in this region where maximum temperature ranges from 39^0 c to 40^0 c. As compared to eastern portion and delta

area, western portion record the lowest and highest temperatures during winter and summer respectively. Highest day temperature recorded in the basin is 50.3^0 c in June, 2003.

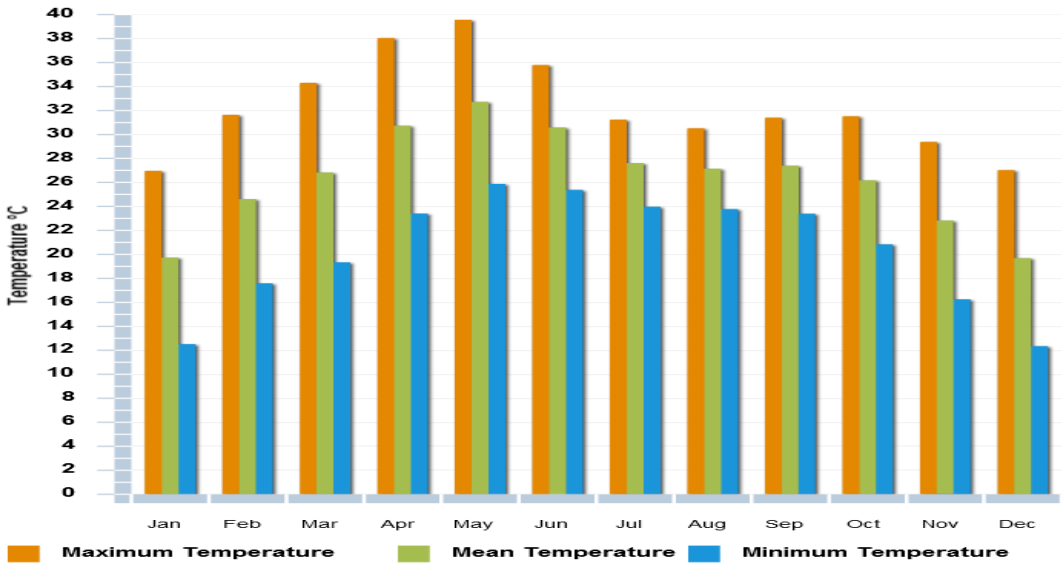


Fig 4: Monthly average temperature (1969-2004) (CWC Report-2014)

2.5 Land Use And Land Cover

Mahanadi valley is the best known for its fertile soil and flourishing agriculture, which preliminary depends on a network of canals that arise from the river. Rice, oilseeds and sugarcane are the principal crops cultivated in Mahanadi valley. The basin has area of about 79,900 km^2 which is about 57% of the basin area and 4% of the total area of country. Except in the coastal plains Odisha, the basin has an extensive area under forests. The sparse vegetation of the highlands contrasts with the moderately luxuriant vegetation of the river valleys. The coastal plains of Odisha, with a high incidence of rainfall, are predominantly rice growth area. The land utilization pattern of Mahanadi river basin comprise of 37.275% forest area, 10.432% cultivated area, 91.137% area with other uncultivated land excluding fallow land, 4.967% fallow land and 38.187% net snow areas as shown in Figure-5. Cultivated area is the total area used for sowing two or more crops in one calendar year. The net snow area is the area snow for each crop but is counted only once. Out of the total annual irrigation water demand of 11km^2 in the basin, the Kharif season utilizes 7km^2 and Rabi season uses 4km^2. Major land use and associated water use changes that have taken place in the basin in the 20^{th} century are related to intensive irrigation of agricultural areas. In the last decade since 2004–05, land cropped in the Kharif season only (i.e. largely rain fed land) has decreased marginally to 30% and land cropped twice or thrice (i.e. irrigated land) has increased substantially, from about 8% to 15%. The largest increases in irrigated land are in the plains of Chhattisgarh, with the development of major irrigation projects in the upper reaches of the Mahanadi and Seonath rivers. Fallow lands in the basin have decreased from about 17% to about 11% (15,507 km2) in the last five years or so. This is in contrast to the MoA data which shows that fallow and cultural wastelands have increased from 7% to about 9% (14,011 km2).

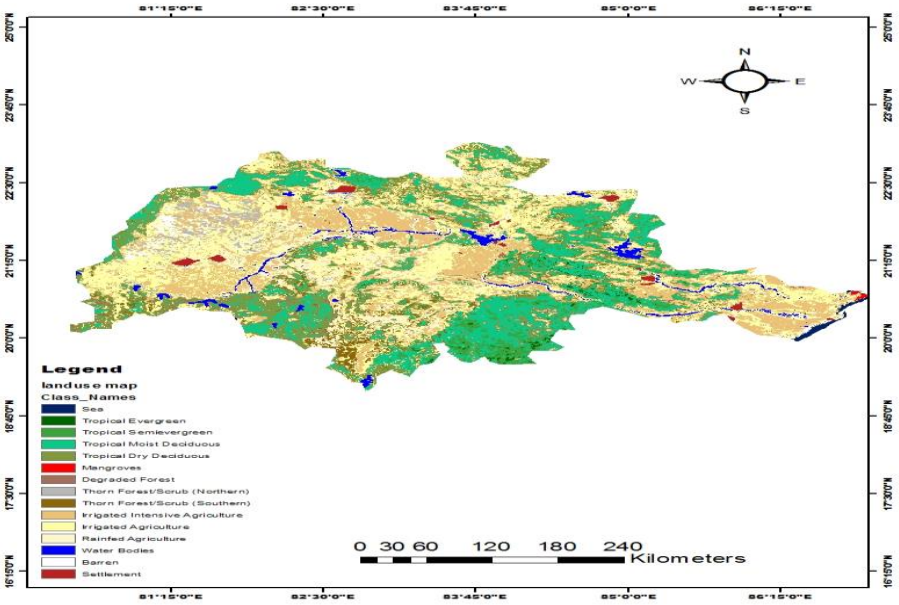


Fig 5: Land use and land cover data for Mahanadi river basin

3 Methodology

3.1 Soil And Water Assessment Tool (SWAT)

The soil and water assessment tool (SWAT) is a continuous, long term, physically based conceptual model. This model operates at basin scale on daily time step (Arnold *et al*. 1998,). SWAT model predicted for impacts of the land use management, sediment and agricultural chemical yield for the development of physically based model. It stimulates the hydrologic cycle in two phase; land phase and routing phase. The land phase aims to control the amount of water, sediment, nutrient and pesticides loading. The routing phase aim to defining the movement of water, sediments etc. through the channel network of the watershed" (Neitsch *et al* 2000). It is a model with Arc GIS interface which has been developed by the USDA-ARS and the Blackland Research and Extension Center (Arnold *et al*. 1998). In this SWAT model, the total catchment is firstly divided into sub-basins or sub-watersheds based on the topographic regions assumed to be lumping further divided into a series of HRUs (Hydrological response units) on the basis of soil, slope and land use combinations. The Green-Ampt infiltration method is one of the options that this model offers to compute excess precipitation at the HRU level, the other one being NCRS curve number method. Simulations are carried out for the components of hydrological cycle, nutrient cycles, sediment yield and aggregate for the sub-basins. The SWAT model can be selected based on the data availability, provides the users with various options when simulation is conducted for the hydrological parameters. The runoff model formed in SWAT is lumped at the sub-basin level, because it computes an average value for spatial varied surface runoff. This one is the limitation of the SWAT model. A SWAT CUP (SWAT Calibration and Uncertainty procedure) model integrate various calibration and uncertainty analysis using the same interface. The SWAT CUP model can run SUFI2 (Abbaspour *et al*., 2007), GLUE (Beven and Binly, 1992) and Parasol (Van Griensven and Meixner, 2006). The SWAT project contains input data and one calibration method to allow user for running a calibration program until convergence is reached. User can save the calibration iteration for the later use. Fig 6 shown the SWAT Model Flow Diagram.

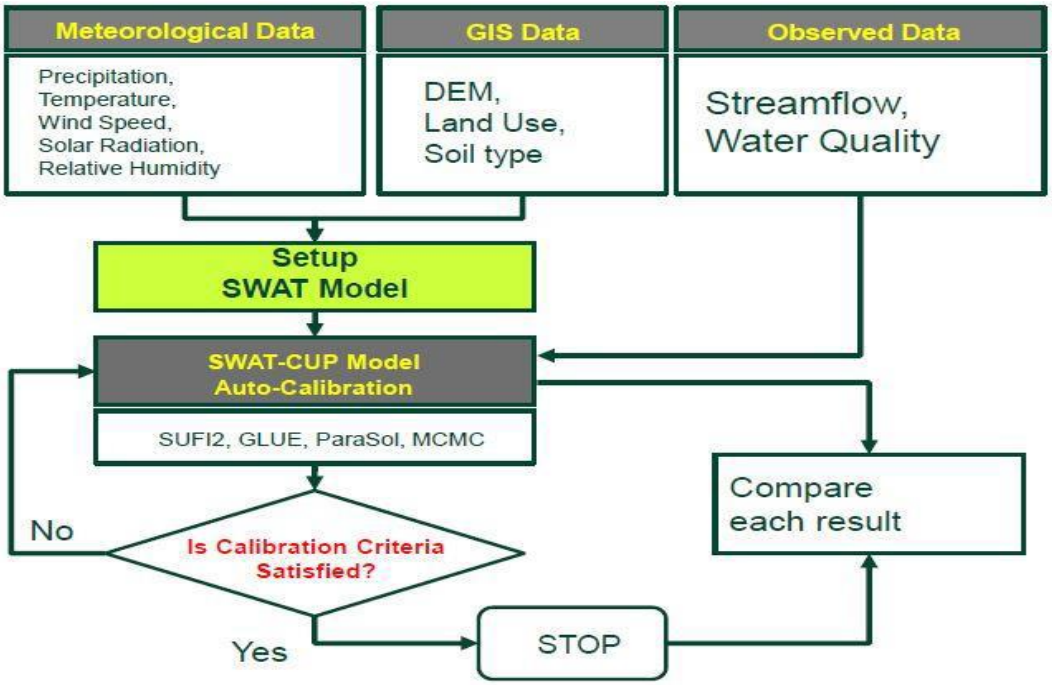


Fig 6: SWAT Model Flow Diagram

4 Result and Discussion

Using Arc SWAT software DEM map, land use map have been represented. By using SWAT-CUP sensitivity analysis of flow parameters, simulated, calibrated and validated results are observed. Monthly calibration and validation for stream flow were performed after conducting sensitivity analysis. The sensitivity analysis performed to determine the optimal parameters best fitted values based upon the observed data collected from study area. Seventeen (2000-2016) year's meteorological and observed stream flow data were used for calibration and validation. Also analysis of land use change and climate change and environmental impact assessment observed and modelled the discharge.Fig 7,Fig. 8 and Fig.9 shown the DEM map, Land use land cover map and Watershed delineation of study area respectively.

4.1 Maps Obtain From Input Data

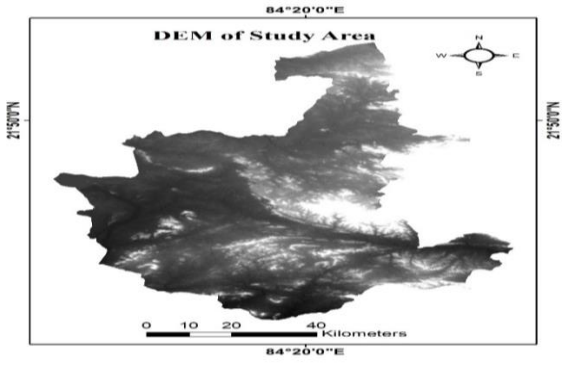


Figure 7:- DEM map

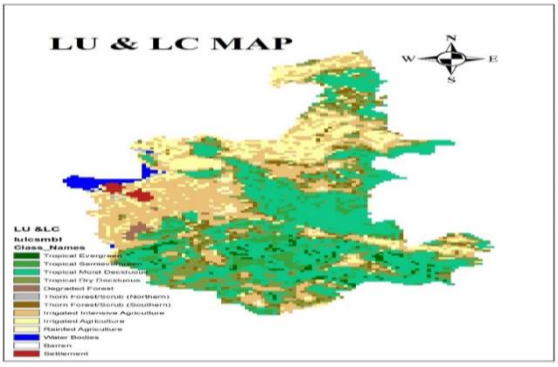


Figure 8:- Land use land cover map

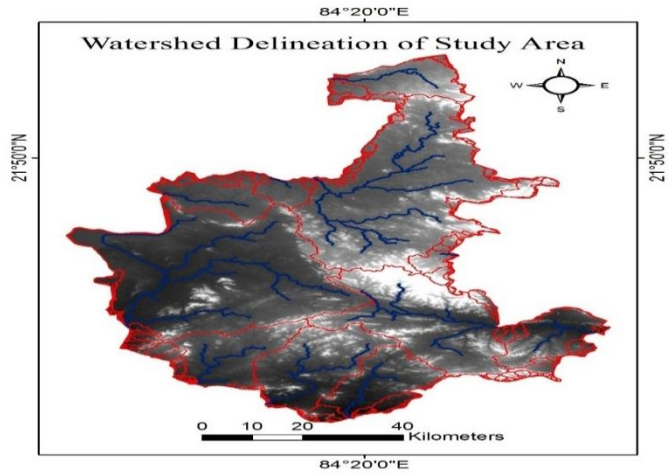


Figure 9:- Watershed delineation of study area

4.2 Sensitivity Analysis

Six parameters were considered for sensitivity analysis to identify the most sensitive parameters. The sensitive parameters which are obtained from the sensitivity were further carried out for calibration. The ranges of various flow calibration were referring to the SWAT CUP from the previously studied journals and user manual. The best fitted values which ranges of the parameter for catchment have been represented in Table 1. Figure 10 shown the Sensitivity analysis of flow calibration parameters**.**

Table 1:- Ranges and best fitted values of flow calibration parameters

SL NO.	FLOW CALIBRATION PARAMETERS	QUALIFIER	MINIMUM	MAXIMUM	FITTED VALUE
1	Curve Number (CN2)	r_	-0.5	0.5	-0.3257
2	Base flow alpha factor (ALPHA_BF)	v_	0	1	0.121564
3	Groundwater delay(days) (GW_DELAY)	v_	30	350	200.01
4	Threshold depth of water(mm) (GWQMN)	v_	0	5000	4219.125
5	Groundwater revap coefficient (GW_REVAP)	v_	0.02	0.3	0.392711
6	Soil evaporation compensation factor (ESCO)	v_	0.01	1	0.512134

Figure 10:- Sensitivity analysis of flow calibration parameters

5 Conclusion

The study area for the present work is a catchment of Mahanadi river basin. The present study has been conducted for Mahanadi middle basin area of Ib tributary. SWAT model has been used which runs under Arc GIS interface and the model input in the form of runoff discharge for the basin. The simulation discharge value calibrate with the observed discharge for the time period of 2003 to 2011 and validation time period 2012 to 2016.Four sub-basin and five HRUs are found to exist the region from the delineation result from Arc SWAT.For the SWAT-CUP model for six parameters taken for the calibration and validation of model analysis and the flow calibration parameters are considered from literature review and self-interpretation.

6 References

- Abbaspour, K. C., Faramarzi, M., Ghasemi, S. S., & Yang, H. (2009). Assessing the impact of climate change on water resources in Iran. *Water resources research*, *45*(10).
- Beven, K. J., & Kirkby, M. J. (1979). A physically based, variable contributing area model of basin hydrology/Un model a base physique de zone d'appel variable de l'hydrologie du bassin versant. *Hydrological Sciences Journal*, *24*(1), 43-69.
- Devak, M., & Dhanya, C. T. (2014). Downscaling of precipitation in Mahanadi basin, India. *Int. J. Civil Eng. Res*, *5*, 111-120.
- Gosain, A. K., Rao, S., & Arora, A. (2011). Climate change impact assessment of water resources of India. *Current Science*, 356-371.
- Mohapatra, M., & Mohanty, U. C. (2006). Spatio-temporal variability of summer monsoon rainfall over Orissa in relation to low pressure systems. *Journal of earth system science*, *115*(2), 203-218.
- Mujumdar, P. P., & Ghosh, S. (2008). Modeling GCM and scenario uncertainty using a possibilistic approach: Application to the Mahanadi River, India. *Water Resources Research*, *44*(6).

- Qiu, L. J., Zheng, F. L., & Yin, R. S. (2012). SWAT-based runoff and sediment simulation in a small watershed, the loessial hilly-gullied region of China: capabilities and challenges. *International Journal of Sediment Research*, *27*(2), 226-234.

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
(An Institute under Ministry of HRD, Govt. of India, New Delhi)
Ashok Rajpath, Patna – 800005

Dr. Ramakar Jha
Chair Professor & Head
Department of Civil Engineering

Email: rj@nitp.ac.in, rjha43@gmail.com
Tel.: +91 0612 269130 (Ext) 122(O)
Web site: www.nitp.ac.in

To,

Dear S.Behera, K.Rout, and Dr. Bandita Naik,

Subject: (a) Acceptance of Research Paper for ORAL Presentation
(b) Submission of Registration Fee for its publication in Proceedings

Ref.: Paper No. 445 (Loss coefficient for Contraction in Converging Channel)

It is my pleasure to inform you that your above referred research paper has been accepted for ORAL PRESENTATION in the very prestigious International Conference HYDRO-2018-INTERNATIONAL.

You are requested to kindly make online payment of Registration Fee for at least one Author and Co-authors attending the Conference and send the duly filled Registration Form by 2oth November 2018. **The research papers are likely to be published in the Proceedings (Springer) only after the receipt of registration fee from the author.** E-poster Template is attached too.

Looking forward to see you in HYDRO 2018 International at NIT Patna.

With kind regards,

(PROF. (DR.) RAMAKAR JHA)

Chair, HYDRO-2018-INTERNATIONAL

hydro2018international@gmail.com

Loss coefficient for Contraction in Converging Channel

S.Behera[1], K.Rout[2], B.Naik[3]

[1]*M.Tech Student, Department of Civil Engineering, CAPGS, BPUT, Rourkela, India*
[2] *M.Tech Student, Department of Civil Engineering, CAPGS, BPUT,Rourkela, India*
[2]*Resource Person, Department of Civil Engineering, CAPGS,BPUT, Rourkela, India*
Email: beheraswagatika001@gmail.com
Telephone/Mobile No.: +919438139100

Abstract

In this present work, a hydraulic study was done on the contraction section of Kaskaskia River Reach-1, Illinois (USA), and Nani.G. Bhowmik. The data set of flow variables was collected from the Kaskaskia River-1. Investigation on loss coefficient were done on the contraction sections of Kaskaskia River of two 14 – 16 and 16- 17 and converging angle of 1.24° and 0.63° respectively. This study was done to understand the effect of flood on non-prismatic converging channels. The ANSYS Fluent software was used for four different turbulence model like *k-w, k-e, LES, RANS* on the contraction section of Kaskaskia River. Among all the models LES was given the best results. Predicted velocity was found nearly equal to the observed velocity.

Keywords: Turbulence model, ANSY-fluent, Contraction section Kaskaskia River Nani G. Bhowmilk, k-e, k-w, LES, RANS models

1. Introduction

Likely water is one the most fundamental and important resources available to the mankind. It archives the surface earth through methods for precipitation and after that is conveyed that around waterway channel to join the ocean. This phenomenon is more complex in non-prismatic compound channels with converging floodplains due to change in geometry. In converging compound channel the flow is forced to leave the flood plains and enter the main channel resulting in increased interactions and momentum exchange (Bousemer and Zech (1999), Bousemer et al. (2004), Proust et al. (2006), Rezaei (2006),Naik & Khatua(2014)). This extra momentum exchange should also be taken into account in the flow modelling. Today more than half of the world's population lives within 65km of a sea cost, and most of the major cities are also located on main river systems. So whenever flood occurs, this has lead to increase in the loss of life and economic cost (Knight and Shamseldin (2005).If the liquid particle appear to movie in definite smooth paths and the flow appears to be as a movement of thin layers on top of each other is known as a movement of thin layers on top of each other is known as laminar flow. The liquid particle move in irregular paths which are not fixed with respect to either time or space is known as turbulent flow. The river is the pillar of all progress inhabitants in ancient times, all the major progress and cities grows in the bank of the rivers. The river is the necessary part of human beings at the past and continued in the present because it provides the fertile land and sufficient water production. The river system can be divided as seasonal and year-continued flowing water .The importance was to understand the flow attributes of rivers in both the flow and over flow condition. Here the aim is to find out efficiency of LES (Large eddy simulation), RANS (Reynolds average Navier- Stoke equation), k-ϵ (k- epsilon), k-ω (k- omega) turbulence

models to determine the flow conditions in the contraction section of Kaskaskia River, Illinois (USA) .

2. Study Area

The data set was collected from the Kaskaskia River, Illinois (USA) shown in Figure 1. It consists of two reaches namely Reach-1 and Reach-2.The total drainage area is 5801 square miles. The drainage area at reach-1 is 1330 square miles. We have worked on the Reach-1 River using its data sets. We found four diverging section namely (1-2 and 13-15) and angles (0.50° and 0.17º) respectively. After getting these data these were analyzed using ANSYS (FLUENT) and we get the velocity contours at inlet and outlet of the section. For the validation of the contours, actual contours were needed for which we used the software named SURFER for creating the actual contours which has been founded in the above named river. We have also used the four turbulence models such as *LES* (Large eddy simulation), *RANS* (Reynolds average Navier- stoke equation), k-ω, k-ϵ and finding which was better turbulence model among them.

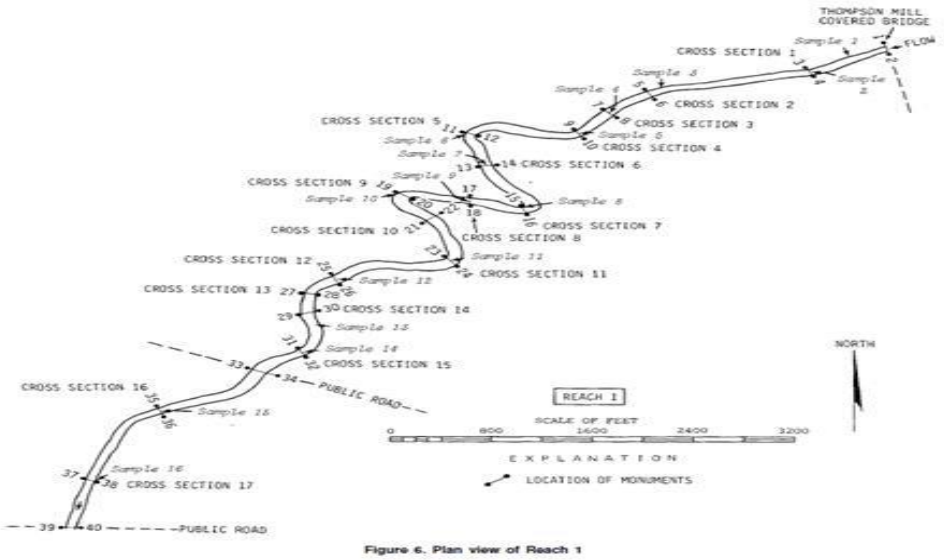


Figure1. Showing Kaskaskia River, Illinois (USA), Reach-1 (Nani G. Bhowmik)

3. Numerical modelling

A number of CFD packages (Fluent, CFX, and Star-CD, amongst others) were available and have been used for research in water flows. In recent past, a good number of researchers have used these software packages for prediction of different aspects of 3D flow fields e.g. Sahu et. al (2011). They detected that flow features in channels were dependent on topography of the channel, surface roughness etc. However, the flow behavior changes are still an unresolved phenomenon and attempts are underway to address this problem. These researchers attempted to predict the flow behavior using different numerical models as it is difficult to capture all flow features experimentally but still a lot of work is to be done. This is due to various problems which are encountered in numerical modelling such as grid generation, choice of turbulence model, discretization scheme, specifying the boundary and initial conditions etc. In this work, an attempt has been made to apply to diverging channel a

3D numerical code FLUENT has been used to test for its suitability for simulation of flood flows. The models tested here were *k-ε, LES, k-ω* and *RANS*, used for all simulation works.

3.1.Geometry

The first step in CFD analysis is the explanation and creation of computational geometry of the fluid flow region. A consistent frame of reference for coordinate axis was adopted for creation of geometry. Here in coordinate system, x-axis corresponded the lateral direction which indicates the width of channel bed. Y-axis aligned stream-wise direction of fluid flow and Z-axis represented the vertical component or aligned with depth of water in the channel. The origin was placed at the upstream boundary and coincided with the base of the centre line of the channel. The water flowed along the positive direction of the y-axis. The simulation was done on a non-prismatic compound channel with a converging flood plain. The setup of the compound channel is shown in Figure 2.

- Inlet
- Outlet
- Surface Geometry
- Channel Bottom
- Side Walls

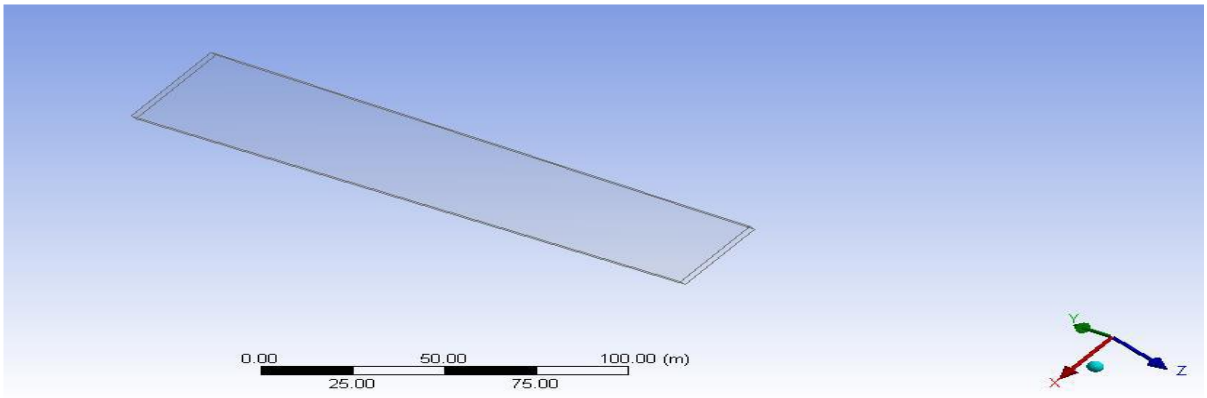


Figure. 2 Showing the geometry of converging channel

3.2 Mesh generation

The second and very important step in numerical analysis is setting up the discretized grid associated with the geometry. Construction of the mesh involves discretizing or subdividing the geometry into the cells or elements at which the variables will be computed numerically. Using the Cartesian co-ordinate system, the fluid flow governing equations i.e. momentum equation, continuity equation are solved based on the discretization of domain. The meshing divides the continuum into a finite number of nodes. The discretization of the computational domain is done through mesh generation, which can be identified later through control volume constructions. However, a very dense mesh of nodes causes excess computational time and memory. For CFD analysis, more nodes are required in some areas of interest, such as near wall and wake regions, in order to capture the large variation of fluid properties. Thus, the structure of grid lines causes further unnecessary use of computer storage due to further refinement of mesh. In this study, the flow domain is discretized using an unstructured

grid and body-fitted coordinates. Unstructured grid is used so that intricacies can be covered under the grid which is left over in structured one.

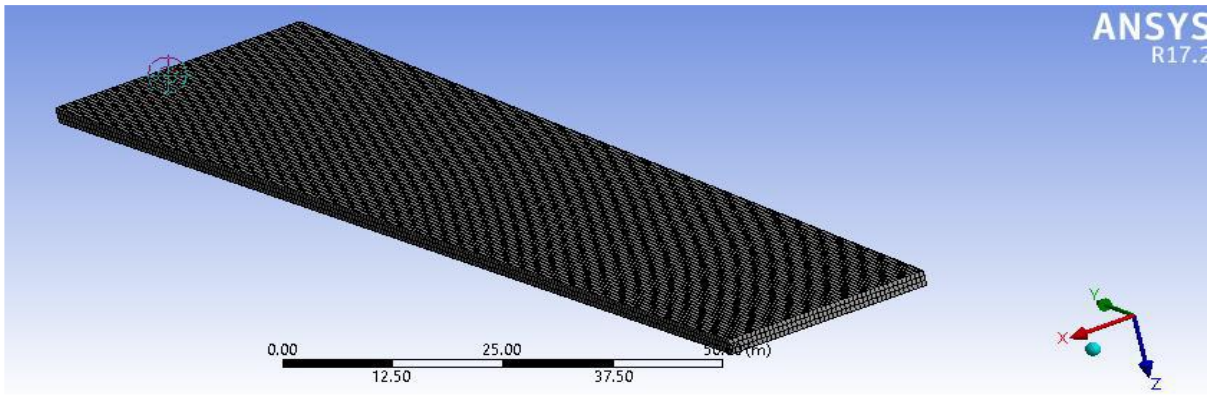


Figure. 3 Showing the mesh generation of simple converging channel

3.3 Solver Setting

3.3.1. Setup

After the meshing part was finished, various data were given in the Setup section. VOF (volume of fluid) model was the only design prepared for open channel flow simulation because this numerical analysis method concern with free surface flow. VOF was able to calculate time-dependent solutions. Flow in an open channel is mainly bound by channel from all directions especially for the rising upward free surface. To attain a free surface zero friction, an instructor called "surface symmetry" was given at the named selection in the computation. Velocity for inlet and pressure outlet for outlet is determined and the roughness coefficient was adjoining to the walls for "no slip" parameters. Temporary flow was chosen as the flow parameters were manifold in time in the experimental. Gravity was marked and the value for Z-axis was given as -9.81m/s² because gravity acts downward opposing to the z-direction vector. As mentioned earlier, the turbulence model was chosen as *k-ω, k-ϵ, RANS* (Reynolds Average Navier-Stoke equation) and *LES* (Large Eddy Simulation) models were used in our analysis. PISO was selected for solving the pressure equation as it was a pressure based algorithm used for short- lived flow conditions. It also allows large time step for precise calculation. Calculation was taken from inlet after the initial values of pressure and velocity were given and y-velocity value was given as water depth of the channel, then it is patch and close. Then it's time for calculation part in which the time step size was set to 0.001s and number of iteration given was 1000 for better accuracy and best results. After the calculation part is over the then we go to the result part where the velocity contours were found at the each section of the channels.

3.3.2. Governing equation

ANSYS Fluent uses the finite volume method to solve the governing equations for a fluid. It provides the capability to use different physical models such as incompressible or compressible, viscous, laminar or turbulent etc. FLUENT is user-friendly and it is applied almost all branch of engineering science dealing with Numerical science. Initially, the closure problem of governing equations was considered as there is no universal closure model which is acceptable for all flow problems. Several models were studied to compare the effect of turbulent modelling in the converging compound channel, including the following: (1) *k-ϵ*, (2) *k-ω*, (3) Large Eddy Simulation (*LES*) model and (4) *RANS*.

(i) *k-ω* and *k-ϵ*

k-ω model is used for turbulence modelling. The *k-ω* model solves the k-transport equation and a transport equation for *ω*. The k-transport equation and the transport equation for *ω* can be written (Wilcox 1988) as:

$$\frac{\partial k}{\partial t} + U_i \frac{\partial k}{\partial x_i} = \frac{\partial}{\partial x_i}\left(\frac{v_t}{\sigma_k}\frac{\partial k}{\partial x_i}\right) + P - \beta' k\omega \quad (1)$$

$$\frac{\partial \omega}{\partial t} + U_i \frac{\partial k}{\partial x_i} = \frac{\partial}{\partial x_i}\left(\frac{v_t}{\sigma_\omega}\frac{\partial k}{\partial x_i}\right) + \alpha\frac{\omega}{k}P - \beta\omega^2 \quad (2)$$

And the eddy viscosity is given by:

$$v_t = {}^{k}/_{\omega} \quad (3)$$

Where *k* is the turbulence energy, *ω* is the turbulence dissipation rate and *p* is the turbulence kinetic energy production term. The turbulence equation was suggested by Menter (1994) as:

$$P = min\ (P,\ 10\beta' k\omega) \quad (4)$$

The *k-ω* model involves five empirical constants *β', β, α, α_k* and*α_ω*. They have their universal constant values which have been derived on the basis of high quality data. Their values vary from one turbulence model to another. For any particular turbulence model, the values these constant remains same for all simulation purposes. For standard k-ω, their values are presented in Table 1.

Table 1 values of the constant in the k-ω model

β'	B	α	σ_k	σ_ω
0.09	0.075	5/9	2	2

(ii) Large eddy simulation (*LES*)

Large eddy simulation (*LES*) attempts to partially resolve turbulence. The fundamental idea was that the small scales of turbulence can be modelled by a sub grid model, while the larger scales are resolved by the governing equations. This equation (5) was no uses in the turbulence model since new unknown's correlation appear in the turbulent transport and dissipation terms. The governing equation was;

$$\frac{\partial k}{\partial t} + U_i \frac{\partial k}{\partial u_i} = -\frac{\partial}{\partial x_i}\left[\overline{u_i'\left(\frac{u_j u_{j'}}{2} + \frac{p}{p}\right)}\right] - \overline{u_i u_j}\frac{\partial u_i}{\partial x_j} - v\,\overline{\frac{\partial u_{i'}}{\partial x_j}\frac{\partial u_{i'}}{\partial x_j}} \quad (5)$$

(iii)*RANS* (Reynolds Average Navier-Stoke Equation)

The Reynolds stress models (RSM) were more complicated than the eddy viscosity model. They provide a more accurate representation of the turbulence and valid over a wide range of flows. *RANS* equation was the time averaged equations of motion for fluid flow and primarily used to describe turbulent flows. These equations can be used with approximations based on knowledge of the properties of flow turbulence to give approximation time- averaged solutions to the Navier- Stoke equation. The governing equation was;

$$\frac{D\overline{u_i' u_j'}}{Dt} + \frac{\partial}{\partial x_k} T_{kij} = P_{ij} + R_{ij} - \epsilon_{ij} \quad (6)$$

4. Result

4.1. Comparison of Actual Velocity Contours and ANSYS Velocity Contours

The non-prismatic converging sections were collected from Kaskaskia River reach-1 and the velocity contours of each cross section are plotted using software called SURFER (15.0). Similarly, velocity contour are plotted using ANSYS Fluent, by taking four turbulence models. Four turbulence model were taken such as *k-ε, k-ω, RANS, LES*. The figure 4 show the actual velocity contour for section-1 and the figure 5 (a, b, c, d) show the ANSYS velocity contour for section-1 using four turbulence model such as *k-ε, k-ω, RANS, LES*. The figure 6 shows the actual velocity contour for section-2 and the figure 7(a, b, c, d) show the ANSYS velocity contour for section-2 using four turbulence models. The figure 8 shows the actual velocity contour for section-17 and the figure 9(a, b, c, d) show the ANSYS velocity contour for section-17 using four turbulence models.

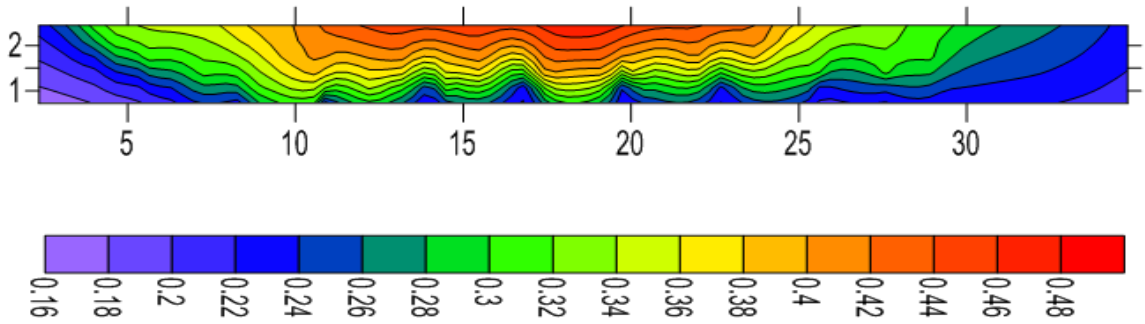


Figure 4. Showing the velocity contour section -14

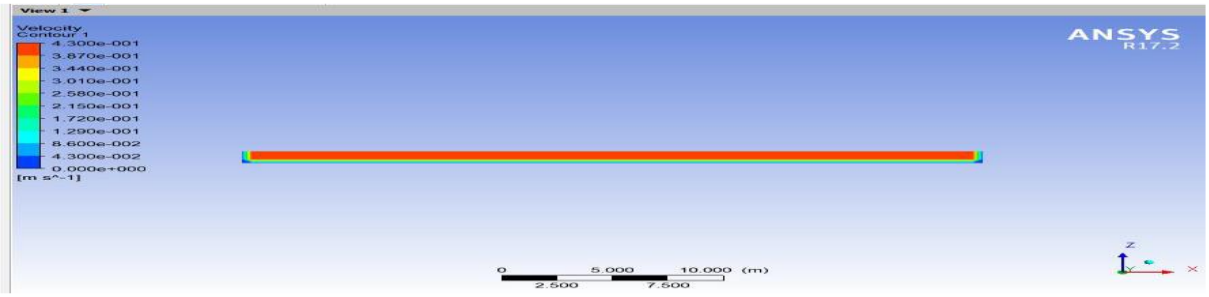


Figure 5(a) Showing the velocity contour for section-14 *k-ϵ* model for converging angle-1.24^{o}

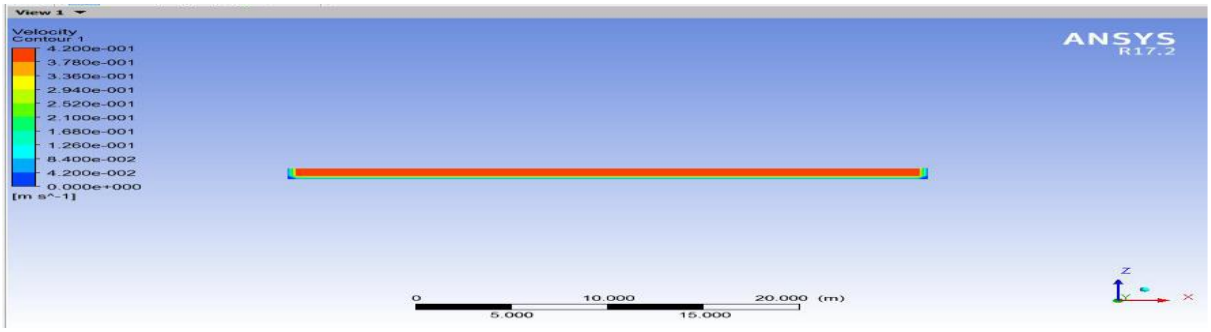


Figure 5(b) Showing the velocity contour for section-14 *k-ω* model for converging angle-1.24°

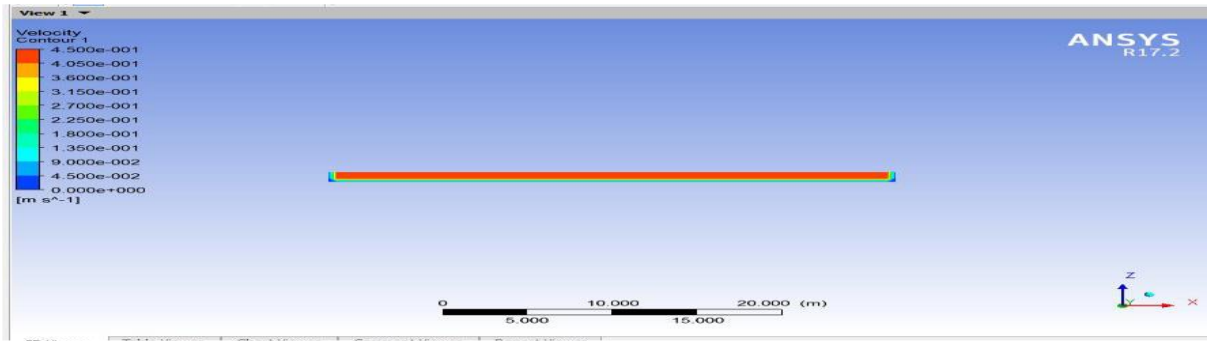


Figure 5(c). Showing the velocity contour for section-14 *RANS* model for converging angle-1.24°

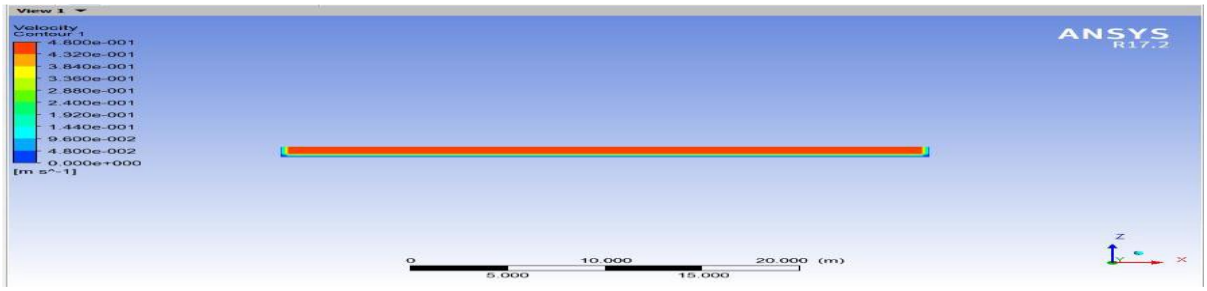


Figure 5(d). Showing the velocity contour for section-14 *LES* model for converging angle-1.24°

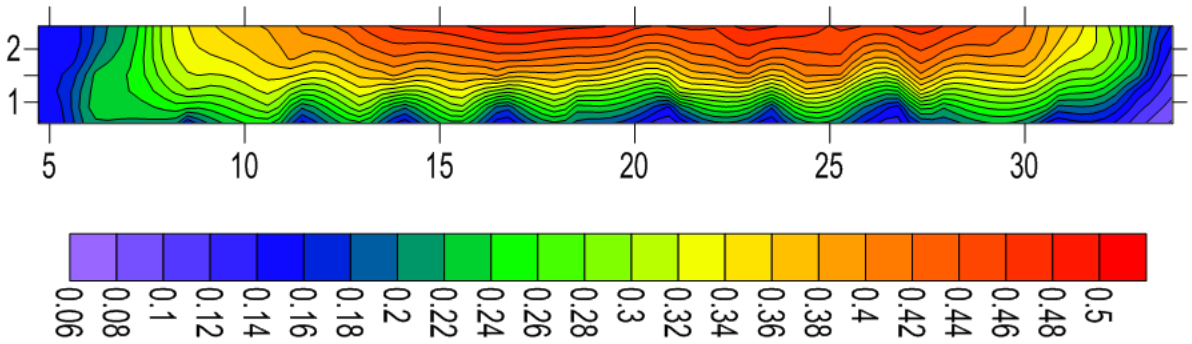


Figure 6. Showing the Velocity contour of section-16

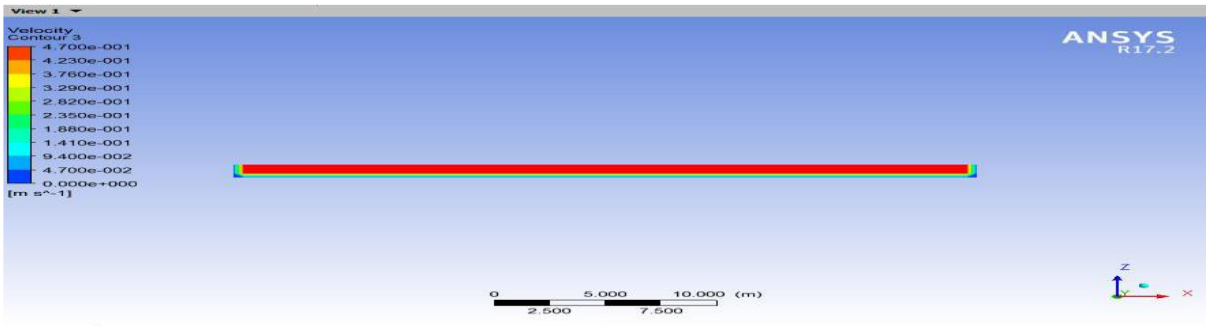


Figure 7(a) showing the velocity contour for section -16 *k-ϵ* model for converging angle-0.63°

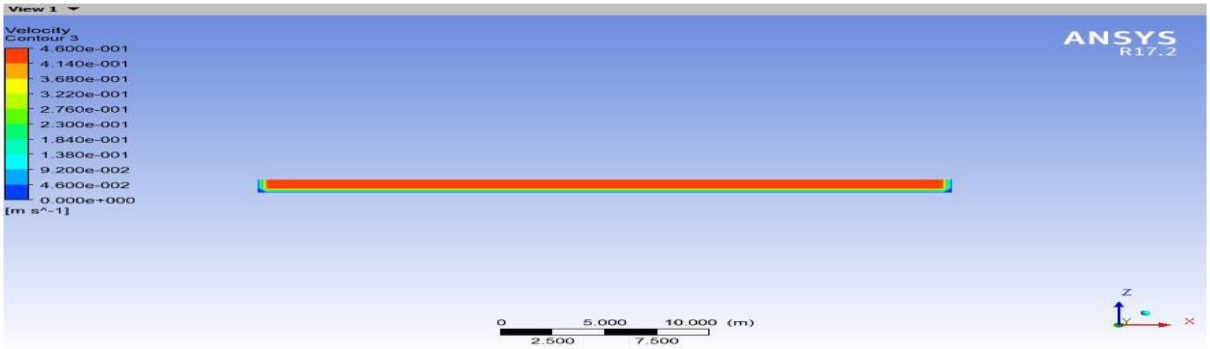


Figure 7(b) showing the velocity contour for section-16 *k-ω* model for converging angle-0.63°

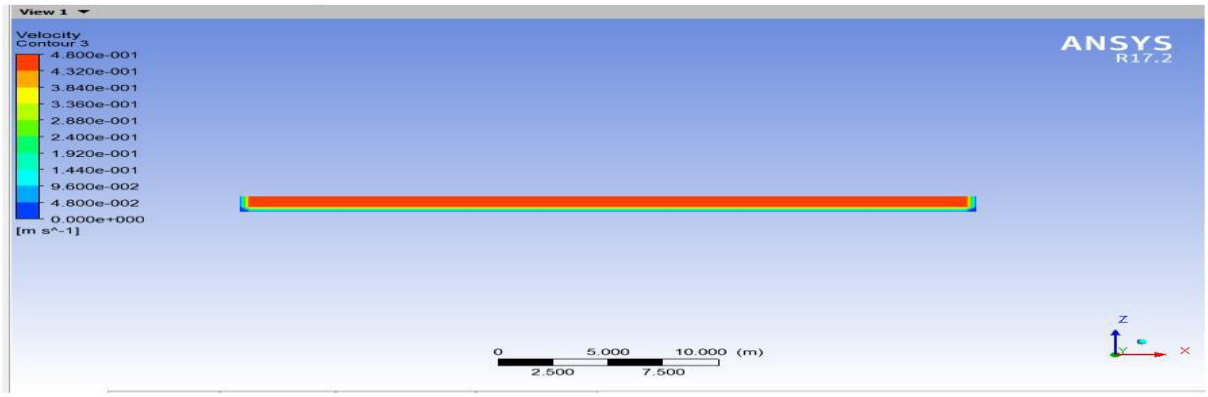


Figure 7(c) showing the velocity contour for section-16 *RANS* model for converging angle-0.63°

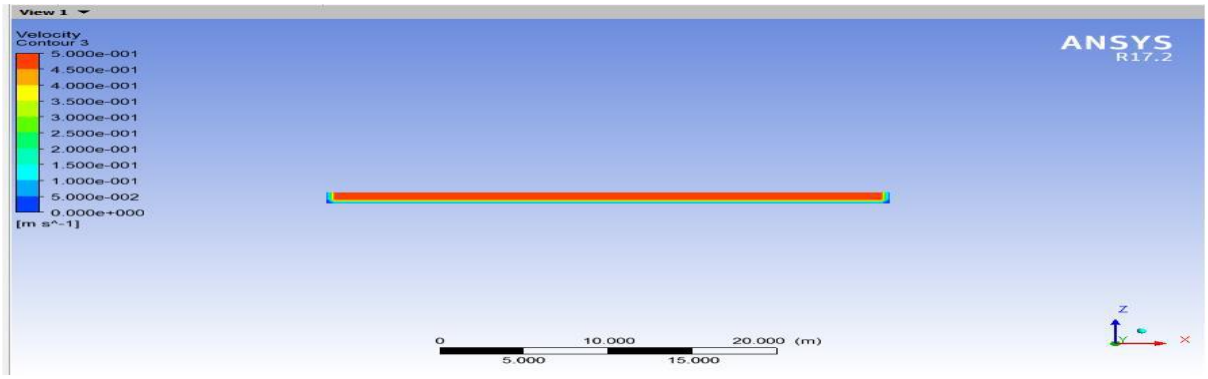


Figure 7(d) showing the velocity contour for section-16 *LES* model for converging angle-0.63°

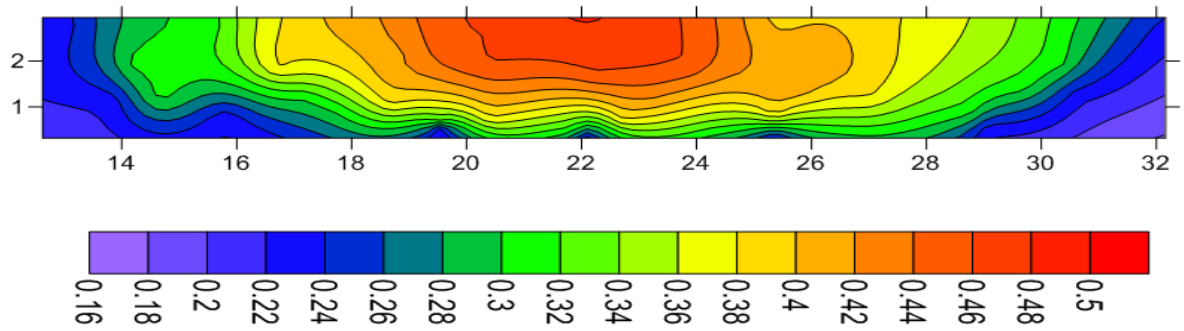


Figure 8. Showing the Velocity contour of section-17

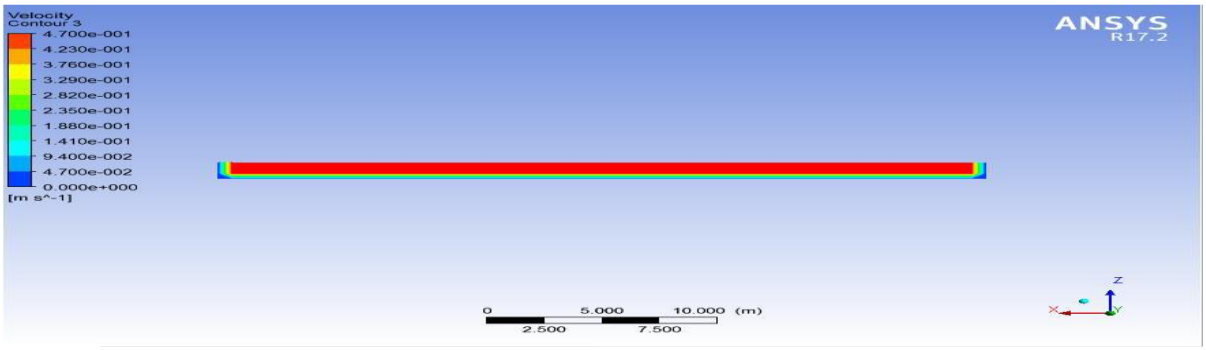


Figure 9(a). Showing the velocity contour for section -17 *k-ϵ* model for converging angle-0.63°

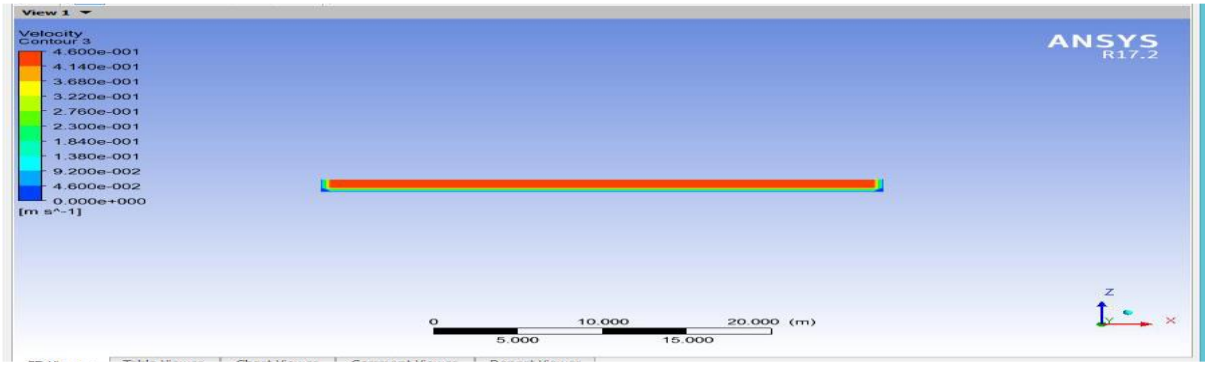


Figure 9(b). Showing the velocity contour for section -17 *k-ω* model for converging angle-0.63°

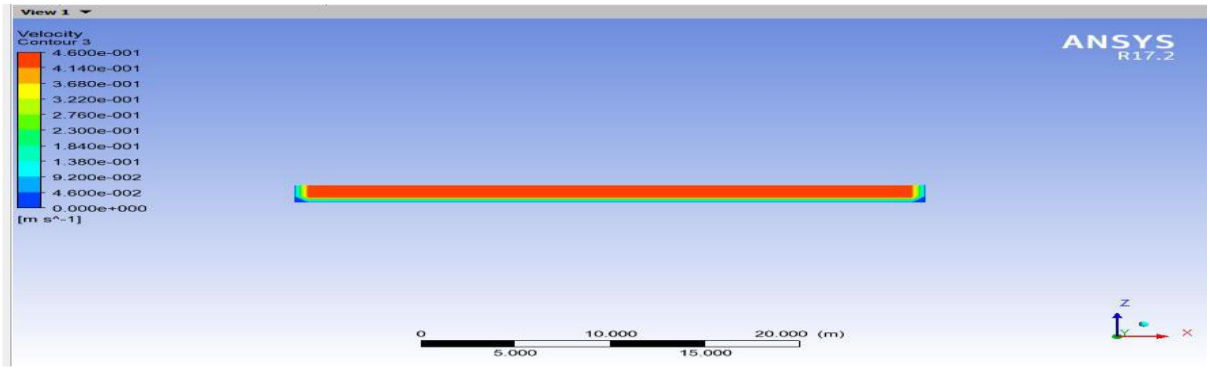


Figure 9(c). Showing the velocity contour for section -17 *RANS* model for converging angle-0.63°

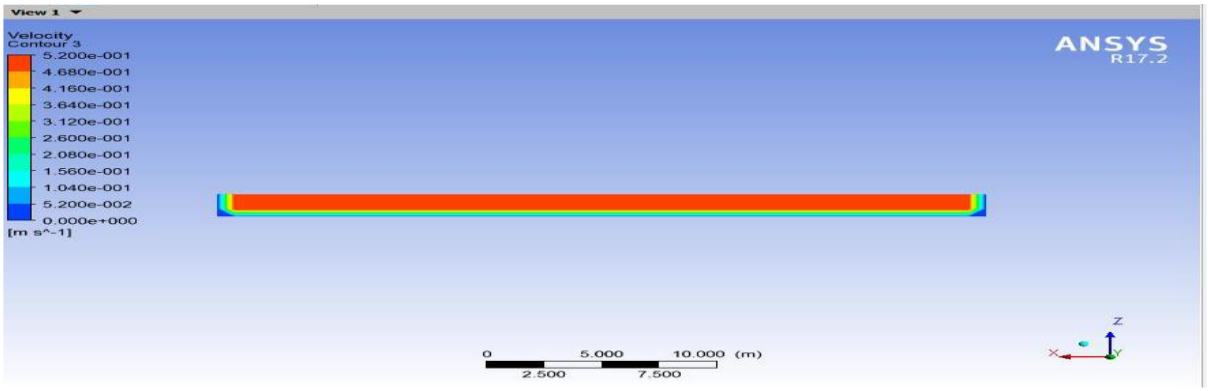


Figure 9(d). Showing the velocity contour for section -17 *LES* model for converging angle-0.17°

5. Conclusions

The analysis was performed in Kaskaskia River, Illinois (USA) for finding out the expansion section of reach-1 from it. It was found two expansion sections of (14, 16 and 17) with the expansion angle of 1.24° and 0.63° respectively. The real contours were drawn from software called SURFER and validate these contours with the ANSYS contour. It was concluded that the velocity increased in the converging sections and increased with the increase of flow. The study of observed velocity and predicted velocity was done using ANSYS FLUENT. *LES* was found to be best model among *k-ϵ*, *k-ω* and *RANS* for predicting velocity in diverging channel because it giving more accurate result than other models.

6. References

Alexandrov, S., & Barlat, F. (1999). Modelling axisymmetric flow through a converging channel with an arbitrary yield condition. Acta mechanica, 133 (1-4), 57-68.

Gandhi, B. K., Verma, H. K., & Abraham, B. (2010). Investigation of flow profile in open channels using CFD. *Roorkee, India.*

Knight, D., & Shamseldin, A. (Eds.). (2005). River basin modelling for flood risk mitigation. CRC Press

Khatua, K.K., and Patra, K.C. (2008). "Boundary shear stress distribution in compound open channel flow." *J. Hydraul. Eng. ISH*, 12(3), 39–55.

Menter, F. R. (1994). Two-equation eddy-viscosity turbulence models for engineering applications. *AIAA journal*, *32*(8), 1598-1605.

Sahu, M., Khatua, K.K., and Mahapatra, S.S. (2011). "A neural network approach for prediction of discharge in straight compound open channel flow." *Flow Measure. Instrument.* 22, 438–446

Wilcox, D. C. (1988). Reassessment of the scale-determining equation for advanced turbulence models. *AIAA journal*, *26*(11), 1299-131.

Grenze International Journal of Engineering and Technology, Special Issue

Analytical Approach of Trivium FPGA Implementations against Information Security Vulnerability

Ch. Suresh[1] and M. Mahesh Babu[2]
[1-2]Electronics and Communication Engineering Dept, Methodist College of Engineering and Technology, Hyderabad 500001, India
Email: chiruvellasuresh@gmail.com, mahibabu606@gmail.com

***Abstract*—The focus of this work is addressing the issue of the information security along with to introduce faults in Trivium stream ciphers implemented on FPGA. Daily, an incredible amount of information is exchanging in many digital forms. The digital devices have become the data sources which pump out the majority of the information on the web. The evolution of the Internet of Things (IoT) has come up with innovative solutions and its demand for information security is indeed a challenging task to maintain the sensitive information integrity in an ensured way. The implementation of cryptographic algorithms in IoT provides lightweight solutions which are simpler in design. Trivium stream cipher is a cited example for IoT cryptographic lightweight initiative which is also a noted finalist of the eSTREAM project. The previous studies show that the cryptographic algorithms are regarded as vulnerable sources when it comes to hardware implementations. A simplified approach was proposed to study the vulnerability behavior field-programmable gate array (FPGA) implementations of Trivium stream ciphers against various attacks. A description of the system design alterations in the clock signal has provided. The Trivium cipher and their routing dependences are thoroughly tested with two different FPGA families to know the vulnerability and, the results show that all cases of Trivium cipher are vulnerable to fault attacks.**

***Index Terms*— Information security, FPGA, Vulnerability, Trivium cipher, IoT, Differential Power Analysis, Logic gates.**

I. INTRODUCTION

The amount of information transmitted and exchanged between the digital devices in this information era has increased drastically. The development happened in VLSI circuits in the past three decades reduce the device cost substantially and makes them more user-friendly and cost-effective [1]. The information that is exchanging in the communication networks needs the high-profile security system to protect the sensitive information from malicious sources. The cryptographic systems are designed to provide robust security to the information that is exchanging between various network channels. The progress on this subject keeps on improving with the development of the new technologies.. The primary parameters that are affected due to the second side of attack on-device hardware are power consumption, electromagnetic radiation and so on [2].

Grenze ID: 01.GIJET.4.3.36

Differential Power Analysis (DPA) and the Correlation Power Analysis (CPA) are the types of side-channel attacks are known for their ability to attack the system circuitry based on the power consumption measurements. On the other hand, the Active Fault Analysis attacks can actively attack the system circuitry through the operation conditions modifications to inject or insert the faults into the system circuitry.The proposed methodology presents an aspectual behavior and analysis of Trivium Cipher and its FPGA (Field-programmable gate array) executions in contrary to the error (fault) injections occurs in the clock signal.

II. BACKGROUND

A. FPGA

The FPGA is Field Programmable Gate Array. It is typically an integrated circuit with logic gates ranging from 10,000 to more than a million. They are called as semiconductor devices connected by programmable interconnections to accomplish the functions easily for the designers and the users. FPGA devices process reprogrammable ability even after manufacturing to desired application requirements and, this unique ability separates it from a matrix of configurable logic blocks (CLBs) [3].

III. EXISTING WORKS

Although the Trivium cipher gains the popularity of being a finalist in the project eSTREAM on the other end it failures in **many** aspects remain a concerned thing. Many works reported in the past have given the detailed explanation about the strangeness of the Trivium against DFA. In the initial stage, the majority of the papers focus on the theoretical analysis and the endangered security of the Trivium is the solo concern addressed in all works. Injecting a faulty bit in the internal state of the system by an unauthenticated source keeps the security of the system on the verge [3-5].The random fault injections in the hardware implementations by an unauthenticated source can create a tendency to break the cryptographic circuits security within a lapse of the timeline as reported by Boneh et al. [8]. Anderson and Kuhn [9] have come up with the unique concept of fault injection analysis.

Author, Contribution and the Methodology
Authors: R. Mahmoud, T. Yousuf, F. Aloul, and I. Zualkernan. **Year:** December, 2015 **Contribution:** Challenges and the current status of the IoT networks in providing the security to the information exchanged in the online sources. **Methodology:** Internet of things has made its mark in the field of security and, it is also called trending technology in the information era. IoT offers an ocean of the opportunities to built new applications by providing the possible solutions. This paper highlights the point that a vast amount of work needs to be done to make IoT more user friendly [4].
Authors: M. Hojsík and B. Rudolf **Year:** December, 2008 **Contribution:** Analysis of the Trivium in terms of software implementation. **Methodology:** The Trivium design has come up with three different shift registers. The fast software implementation results in unresolved issues which may give scope to the unauthenticated sources to drive into the system and create the faulty bits which can affect the overall system performance [7].
Authors: F. E. Potestad-Ordóñez, C. J. Jiménez-Fernández, and M. Valencia-Barrero **Year:** November, 2016 **Contribution:** This existing work adds the significant contribution to the analysis of implementations of the FPGA against various tedious attacks. The experimental results of this paper show the sensitivity of the clock signals in the FPGA Trivium. Controlling the timing is yet another feature of this work. **Methodology:** The detection of the aspectual bits which makes the system sensitive to the various attacks is the prime motto of this work. Authors have taken the time parameter for detecting them, but this parameter is not useful. A study was done on different faulty frequencies and, it carried on till the system can find the optimum frequency. The optimum frequency, by which possible number of frequencies (faulty) can easily penetrate into the system which eventually impacts the system performance [9].
Authors: Dan Boneh, Richard A. DeMillo **Year:** 1997 **Contribution:** In the year 1997 Dan Boneh and his associates came up with a unique methodology which helps the future experiments. Every work discusses the attacks and its impact on the system performance, but this is the first work which mainly focuses on the attacks and its classification. Every VLSI and FPGA experiment must pass through two environments, one is software which deals with the design and system work and another one is the hardware where the chip design came out in physical shape. **Methodology:** The Chinese remainder theorem and its RSA based implementations have the significant place in the field of FPGA. The erroneous signatures are the new mechanism which can have the ability to breaking the RSA based implementation. The sensitivities of the FPGA integrated circuits have analyzed in this work by using Fiat-Shamir and Schnorr protocols. The Fiat-Shamir protocol is

needed less erroneous signatures compared to Schnorr protocol. But these identifier protocols are useful in finding the hardware faults. [8].

IV. Proposed Methodology

A. Contribution

The proposed methodology contribution over the existing methodologies is discussed in this section. The Trivium based FPGA implementations have gained attention due to its unique potentialities. In the year 2016 [5], a paper was published on standard Trivium and, the detailed experimental analysis has been carried out using the standard Trivium stream cipher implemented in a Spartan III Xilinx FPGA has shown the preliminary results. In the preliminary results, the fault detection has been detected by the fault injection in the variations of the clock signals. In the same year [6], another paper was published to show the time delays and valid comparisons between the static and post route approaches.

B. Aim and overview

The fault attacks are the most concerning aspect in the Trivium based FPGA implementations. The aim is to study the vulnerability behavior of the various Trivium designs to fault attacks. Applying the fault injection system to the different Trivium designs helps to detect the faulty bits in the both real and simulation experiments. The experiment to detect the faulty bits from fault injection system follows the systematic approach. The whole experiment has done on the standard Trivium with four different Trivium designs to the two different FPGA families for the implementation.. The final values are obtained by having a valid comparison of the real results with the simulation results.

C. Trivium Stream Cipher

The stream project is one of the significant works ever done in the history of the FPGA and, the main motto of the project is to design a system which has the best security system.. It is known for generating the 80 bits secret key along with 80 bits initialization vector (IV). This secret key along initialization vector (IV) is used to generate the ^{264} bits of key stream.. When an algorithm is initialized in the Trivium, it makes use of three shift registers along with one secret key. But the system needs to cycle 1152 clocks in order to generate a valid secret stream which eventually helps to generate the key stream. The inner state has a dense distribution of 288 bits in three different shift registers and, each of the shift registers has its own length to its contrary. The first shift register distributed with 93 bits, in the later shift register a total of 93 bits are distributed and, in the final shift register, a total of 111 bits are distributed uniformly. The combinational logic circuitry use XOR and the AND operations to generate the feedback in the shift registers. The depicted figure 1 shows the Trivium schematic representation.

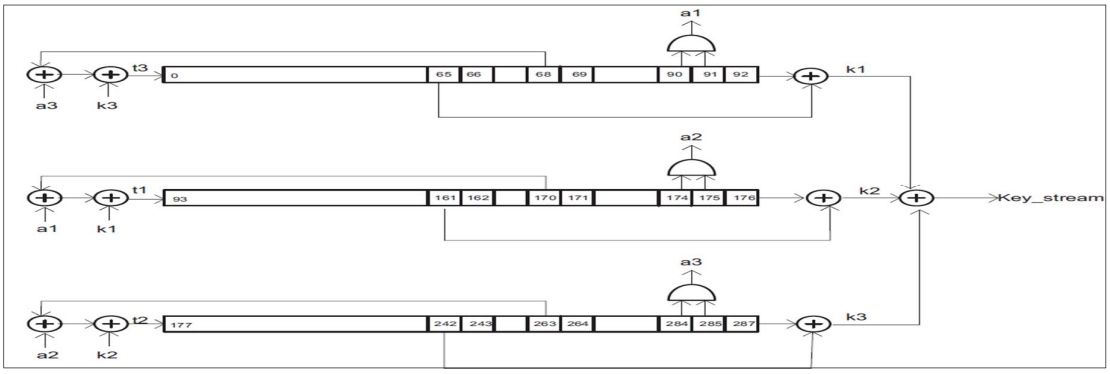


Figure 1: Schematic representation of Trivium stream cipher

The fault injection side channel attacks are thoroughly analyzed and studied for the Trivium cipher. Hojs´ık and Rudolf have proposed the initial work on this subject. In this method a method is known as differential fault analysis (DFA) is used in the encryption of the decryption process. The authors are succusesful inserting the fault bits into the inner state of the system. This approach shows that the attacker gets the tendency to change the only one bit of the inner state of the system.. Although the initial works primly focus on the fault

injection, the latter works mainly focus on generating the secret key based on the fault injection bits. The number of fault injections is kept on reducing with the development of the new algorithms.

D. Standard Multi-Radix Trivium Hardware Implementation

The FPGA integrated circuitry helps to design various applications for different fields. The internal (software) as well as external (hardware) security remains as a topic of research from over the years. The proposed approach has Trivium which is a stream cipher and, it can have the tendency to generate the 264 bits pseudorandom key stream. From these 264 bits, an 80-bit secret key along with 80-bit initialization vector created and it is initially proposed by two innovative scholars namely De Canniere and Praneel. A cyclic shift register has taken to account for internal state registers, and this cyclic shift register is 288-bit Cipher architecture. The same internal state of the Trivium cipher generated these radices and based on the requirement some bits of these radices move to the right as shown in the schematic representation of the cipher.

E. Important Considerations

Three important considerations

a) The FPGA integrated circuitry with Trivium is an excellent combinational design with internal logic. The frequencies the above the design threshold value filtered by the FPGA. These frequencies are not useful.
b) The selection of the frequency has been a challenging as the frequencies just below the designed threshold must be chosen for the system control. The fault bits insertion in the Trivium is possible by the above frequencies.

F. System Design

The main motto of the proposed algorithm is to introduce the faults in the system Cipher Trivium. The proposed system has the ability for remembering the number and location. The proposed circuitry has possessed the ability to adjust the clock signal and this ability help to control the clock signal even at the low pulses. The proposed algorithm can alter the clock signals in a defined fashion as shown in Figure 1
Although the proposed methodology can modify the short pulses of the clock signals, no algorithm can able to explain the impact of these short pulses on the inner state of the system and its perceptual performance. In the simulation results, this scenario happened vividly. In order to overcome this issue, this short pluses impact is altered in the internal state where the number of samples is sampled for operations.

V. Results and Analysis

In this experiment, The experimental analysis carried out by initializing the VHDL (VHSIC Hardware Description Language) as an apt platform to design the fault bit detection mechanism for both clock signal generation and as well as to the Trivium ciphers. Pro Analyzer. The below graphs depicts a comparison between the simulation and the experimental results.

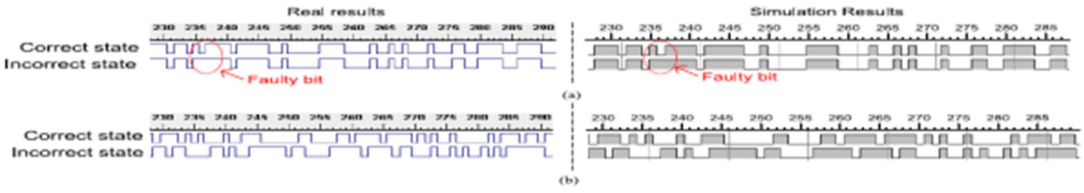


Figure 2: Comparison of experimental and from simulation between correct and faulty internal states

Table 1: Injection capacity and efficiency for Spartan family

	Spartan 3E		Spartan 6	
Trivium	Injection capacity	Injection Efficiency	Injection capacity	Injection Efficiency
Standard	59%	91%	38.44%	100%
S.I.C.	63.75%	68%	42%	92.55%
S.E.C.	56.44%	74.97%	58.66%	80.88%

TABLE II. L.P. TRIVIUM SYSTEM EFFICIENCY

FPGA	Injection capacity	Injection Efficiency
Spartan 3E	37.28%	56.33%
Spartan 6	20.99%	52.66%

V. CONCLUSION

This paper presents the optimized experimental results with elemental analysis. The three perspectives of the proposed methodology are: (a) Performing the fault injection on the proposed Trivium stream ciphers, (b) Implementation of the previous step is possible, once it embeds on the FPGA integrated circuit, and (c) performing the real-time experiments and compare it with the simulation results. The injections carried out in the Trivium ciphers are reckon on the implementation of each stream cipher at clock signal insertion. Finally, the proposed methodology shows that the system has an overall efficiency of 59% and it has the ability of 54% to introduce the faults in the inner states.

REFERENCES

[1] R. Mahmoud, T. Yousuf, F. Aloul, and I. Zualkernan, "Internet of Things (IoT) security: Current status, challenges and prospective measures," in Proc. Int. Conf. Internet Technol. Secur. Trans. (ICITST), Dec. 2015, pp. 336–341.

[2] T. Xu, J. B. Wendt, and M. Potkonjak, "Security of IoT systems: Design challenges and opportunities," in Proc. Int. Conf. Comput.-Aided Design (ICCAD), 2014, pp. 417–423.

[3] M. Hojsík and B. Rudolf, "Differential fault analysis of Trivium," in Fast Software Encryption—FSE. Berlin, Germany: Springer-Verlag, 2008, pp. 158–172.

[4] M. Hojsík and B. Rudolf, "Floating fault analysis of Trivium," in Proc. Int. Conf. Cryptol. India (INDOCRYPT), 2008, pp. 239–250.

[5] F. E. Potestad-Ordóñez, C. J. Jiménez-Fernández, and M. Valencia-Barrero, "Fault attack on FPGA implementations of Trivium stream cipher," in Proc. Int. Symp. Circuits Syst. (ISCAS), May 2016, pp. 562–565.

[6] F. E. Potestad-Ordóñez, C. J. Jiménez-Fernández, and M. Valencia-Barrero, "Experimental and timing analysis comparison of FPGA Trivium implementations and their vulnerability to clock fault injection," in Proc. Conf. Design Circuits Integr. Syst. (DCIS), Nov. 2016, pp. 1–6.

[7] E. Biham and A. Shamir, "Differential fault analysis of secret key cryptosystems," in Advances in Cryptology—CRYPTO. Berlin, Germany: Springer-Verlag, 1997, pp. 513–525.

[8] J. J. Hoch and A. Shamir, "Fault analysis of stream ciphers," in Cryptographic Hardware and Embedded Systems—CHES. Berlin, Germany: Springer-Verlag, 2004, pp. 240–253.

[9] C. Giraud, "DFA on AES," in Advanced Encryption Standard—AES (Lecture Notes in Computer Science), vol. 3373. Berlin, Germany: Springer-Verilog, 2005, pp. 27–41.

CH.SURESH Received the Bachelor degree in Electronics and Communication Engineering (ECE) from the JNTU Hyderabad India and Master degree in VLSI from JNTU Hyderabad, India in 2012.He is working as Assistant Professor in ECE Dept at Methodist College of Engineering and Technology, India His main interests are in the fields of Very Large Scale Integration and Image Processing.

M.MAHESH BABU Received the Bachelor degree in Electronics and Communication Engineering (ECE) from Osmania University, India and Master degree in Digital Systems & Computer Electronics from JNTU hyderabad, India.He is working as Assistant Professor in ECE Dept at Methodist College of Engineering and Technology, India His major interests are in the fields of Very Large Scale Integration and Embedded systems.

2nd International Conference on Paradigms in Engineering & Technology

SOUVENIR

refine your research SCOPUS™

GRENZE Scientific Society

i-manager® Publications

UGC APPROVED JOURNAL

METHODIST COLLEGE OF ENGINEERING & TECHNOLOGY
(Affiliated to Osmania University)
Hyderabad, Telangana
www.methodist.edu.in

The main aim of this conference is to bring scholars, researchers, educators, students, professionals and other groups interested in research to present their works on the developments in various technological advancements. **2nd International Conference on Paradigms in Engineering & Technology (ICEPT)** provides an interdisciplinary platform for academicians and professionals from various Technical fields to share their knowledge, research findings and practices with an academic community and This conference also serves to further the advancement and innovation in learning and teaching.

The papers received are from various departments, *viz.*

- Civil Engineering
- Computer Science and Engineering
- Electronics and Communication Engineering
- Electrical and Electronics Engineering
- Mechanical Engineering
- Master of Business Administration
- Master of Computer Applications

All the accepted papers will be published in Grenze and Imanager Publications

2nd International Conference on Paradigms in Engineering & Technology

ICPET 2018

Souvenir of the International Conference

28-29 December 2018

Organized by

Methodist College of Engineering and Technology

(Affiliated to Osmania University)

Jointly with

GRENZE Scientific Society

i-manager® Publications

Special Thanks for giving the opportunity to:

Sri K. Krishna Rao

Correspondent, MCET

ICPET-2018 Committee

Chief Patron
Sri K. Krishna Rao, Correspondent, MCET

Patron
Dr. M. Lakshmipathi Rao, Director, MCET
Dr. Ravinder G. Reddy, Principal, MCET

Advisory Committee
Prof. S. Ramchandram, Vice-Chancellor, OU
Prof. Sriram Venkatesh, Director, UFRO, OU
Prof. K. Narasimha Reddy, Former VC, MGU
Prof. Pappu Ravi, Queensland University
Dr. Amiya Bhaumik, VC, Lincoln University
Prof. V.R. Sastry, NIT Karnataka, Surathkal
Dr. D. Kishan, Maulana Azad NIT, Bhopal
Dr. H.S. Venkatesh, Director, NIRM
Prof. K. Ramchandrarao, Research Director
Sri P. Krishna Mohan, Sr. GM, Haier India
Dr. R. Sripad Naik, Scientist (Head), NIRM
Dr. S. Mohan Krishna, Alliance University
Dr. M. Chakkarapani, NIT Tiruchirappalli
Dr. Gnane Swarnadh Satapathi, NIE, Mysore
Sri Ramalingeswarudu, GM (HRD), SCCL

Organizing Chairs
Dr. S. Venkateshwar, Dean, MCET
Dr. P. Rajendraprasad Reddy, Vice Principal, MCET

Organizing Committee
Dr. N.H. Shoba Reddy, Head-ECE, MCET
Dr. A. Rajashekar, Head-ME, MCET
Dr. Akshay K. Naidu, Head-Civil, MCET
Smt. P. Lavanya, Head-CSE, MCET
Smt. Y. Mastanamma, Head-EEE, MCET
Dr. K. Anuradha Reddy, Head-H&S, MCET
Smt. Rani Rajan, Head-MBA, MCET

Convener
Dr. G. Raghu Chandra, Assoc. Professor-EEE

Co-Conveners
Dr. R.Ch.A. Naidu, Professor (CSE), MCET
Smt. Y. Mastanamma, Head-EEE, MCET

Hospitality Chairs
Sri A. Sachendra Nath, A.O., MCET
Sri R. Srikanth, Asst. Professor-CE, MCET

Publication Chair
Prof. M. Sudheer, Chief Admin, The IDES
Prof. Renisha Winston, Editorial Director, imanager Publications

Preface

On behalf of the Organizing Committee we extend a hearty welcome to all the dignitaries, distinguished delegates and participants to the "2nd International Conference on Paradigms in Engineering and Technology – ICPET 2018", organized during 28-29th December, 2018. We are happy to announce that the 1st International Conference on Paradigms in Engineering and Technology (ICPET-2016) organized at Methodist College of Engineering and Technology, Hyderabad, India from 02-03 March 2016 was a grand success.

Moving ahead with lots of positive energy, we feel honored to organize the **2nd** International Conference on Paradigms in Engineering and Technology (ICPET-2018) as a sequel to ICPET - 2016. The focus of the conference is on the frontier areas in Engineering, Science, Technology and Management. The idea behind this conference is to help and motivate researchers to carry forward their work to the next level in interdisciplinary areas. This conference provides a vibrant platform to researchers both from India and abroad to showcase their research work and exchange ideas between various cross sections of researchers.

Papers were accepted based on their quality and relevance through **plagiarism check followed by a blind peer review process**, which means the identity of the authors is anonymous to the reviewers. All papers submitted to ICPET-2018 were checked for plagiarism using **Turnitin**. Various subject experts drawn from Reputed Foreign Universities, IITs, NITs, other Institutes of National Importance and Senior Faculty from MCET, have extended their assistance in assessing the quality of the papers as reviewers. Only the papers with the permissible limits of plagiarism were reviewed by two eminent experts in each subject area. ***Based on the consolidated results from the reviewers, papers were accepted.***

In total, ICPET-2018 received **120 papers** and after sophisticated plagiarism checks followed by a peer review process, **80 papers** were accepted for presentation at the conference. All accepted papers were considered for publication in various International Journals and will be available online with open access.

The success of the ICPET-2018 is solely due to the dedicated efforts of all the faculty and staff from the Methodist College of Engineering and Technology. We also place on record the constant guidance and support extended by the correspondent of the college, Mr. K. Krishna Rao, which made this conference a reality.

Finally, the organizing committee wishes that the deliberations during the two day conference will immensely enrich the delegates in furtherance of their research.

Dr. GARIMELLA RAGHU CHANDRA
Convener, ICPET-2018

Smt. Y. MASTANAMMA & Dr. R.CH.A. NAIDU
Co-Conveners, ICPET-2018

About the Institution

Methodist College of Engineering & Technology (MCET) is a Non-Minority Educational institution, established in the year 2008, over 6.53 acre sprawling campus, situated at Abids, in the heart of City of Pearls, Hyderabad (Capital city of Telangana state). The college is well connected by public transport from every corner of the city. This college is imparting Technical education in the fields of Electrical & Electronics Engineering, Electronics & Communication Engineering, Computer Science Engineering, Mechanical Engineering, and Civil Engineering at UG level. In addition, Master of Business Administration courses and ME in Computer Aided Design and Manufacturing (CAD/CAM) are also offered. The Department of Mechanical Engineering of MCET is recognized as Research Centre by OU for carrying out research leading to the award of PhD degree. MCET, having a total student strength of about 2000, is approved by AICTE and is affiliated to the hundred years old Osmania University.

MCET strives towards excellence by imparting essential technical skills as well as a holistic approach towards grooming the students into responsible, worthy citizens of the future. Life in Methodist is not just limited to the classroom teaching, but spins beyond the textbooks to develop character and thus mould the personality of the students to carve a niche for themselves in the society. Ultimate goal of Methodist College of Engineering and Technology is to educate and graduate individuals who possess the technical and social competence and confidence to succeed in professional practice and advanced education, to be lifelong learners, and to exercise responsible citizenship.

The main strength of the college is its best and experienced teaching fraternity totaling to about 130, having interest in both teaching and research work, in their fields of specialization.

However, the college is only 10 years old, is progressing fast and with its excellent infrastructure and state of the art laboratory facilities, is competing with the established engineering colleges having a long standing. MCET students so far secured Three University First ranks and bagged gold medals in the departments of EEE and Mechanical Engineering. This is an ample testimony for the academic progress and the quality of education offered at the college. The college has MOUs with 15 Industries and Institutes that help the students to get internships and carry out project works. All the departments have chapters of Professional bodies like IEEE, IETE, CSI, SAE, ISTE, IGBC etc. Every year it is a regular practice for the college to organize seminars, workshops, symposia and conferences both National and International. As part of the decennial celebrations, the present International Conference is being organized.

MESSAGE FROM CORRESPONDENT

It gives me immense pleasure to know that Methodist College of Engineering and Technology is organizing 2nd International Conference on *Paradigms in Engineering and Technology* during 28-29, December, 2018 and releasing conference proceedings on this occasion. The target group being Engineering Faculty, Scientists and Young Researchers from various Engineering Colleges, industries and research laboratories all over the world, I am confident that this conference will provide a platform for a large cross section to interact with each other and share their academic expertise. I am also happy to note that all the accepted papers are published in Grenze International Journals and UGC approved Journals. I am sure that this two-day conference would be a memorable one and I compliment the Director, Principal, HODs, Faculty and Students of our organization for organizing such an event as a part of Decennial Celebrations of the College. I wish them all success.

Sri K. Krishna Rao
Correspondent
Methodist College of Engineering & Technology

MESSAGE FROM THE DIRECTOR

It is a momentous event for Methodist College of Engineering & Technology (MCET) to organise the 2nd International Conference on Paradigms in Engineering & Technology (ICPET-2018) during 28-29, 2018. MCET, a Non-Minority Educational institution, established in the year 2008 is situated in the heart of the city of Pearls, Hyderabad, Telangana and is affiliated to 100 years old Osmania University, Hyderabad. I deem it as a privilege to place on record that the students from MCET so far have secured Three University First Ranks and Gold Medals. This is an ample testimony for the academic progress and the quality of education offered at the college.

MCET during its rich journey of ten years into academic excellence organized many National Conferences / Seminars /workshops successfully and in addition hosted the 1st International Conference ICPET- 2016. As a sequel to ICPET- 2016, the present Second International conference, ICPET – 2018 is being organized. It is a significant milestone in the history of the college, as this conference is hosted as a part of its Decennial Celebrations. The aim of the conference is to provide a vibrant International forum for the researchers to present, discuss and exchange their significant contributions in all major fields of Engineering, Science and Technology.

Coming to the venue of the conference, the Pearl City of Hyderabad, which was earlier, ruled by Qutub Shahis, Mughuls and Nizams, has a rich history, heritage and culture. Hyderabad is a hub for many National level Educational Institutions of repute, Defence and other National Research laboratories and Public Sector Undertakings. It is also a global home to US giants such as Microsoft, Amazon, Google, Apple etc.

I am confident that the proceedings and deliberations in the conference would be eventful and fruitful. On behalf of MCET, it is my pleasant duty to extend a hearty and warm welcome to all the Dignitaries, Guest Speakers, Delegates and other participants.

I would like to place on record the constant encouragement and support extended by the Management in organizing this Conference.

Sd/-

Dr. M. Lakshmipathi Rao

Director, Methodist College of Engineering & Technology

MESSAGE FROM DEAN (ACADEMICS)

I am extremely happy that Methodist College of Engineering and Technology, is organizing a 2nd International Conference on "PARADIGMS IN ENGINEERING & TECHNOLOGY" during **December 28-29, 2018** on eve of DECINAL CELEBRATIONS of the COLLEGE. Theme of the Conference comprises recent updating of various disciplines such as Civil Engineering, Computer Science Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Business Administration and Applied Sciences. I am sure that this International Conference will address the needs of the Engineering Industry, Research & Development.

More, so it is the forum to share knowledge, experiences and exchange of ideas amongst academicians, researchers, professionals and managers of industry from different parts of the world in particular our country.

I hope that our College will take up more of such events to disseminate information on recent technological developments in various Engineering Disciplines and applied Sciences and act as nuclei in the field as a part of DECINAL CELEBRATIONS of the COLLEGE

I wish the organizers a grand success in this endeavor.

Prof S. Venkateshwar
Dean, Methodist College of Engineering & Technology

Department of Civil Engineering

The department of civil engineering was established in 2013 with an intake of 60 students. Since 2014, the intake was increased to 120 students. The department has well qualified faculty which includes three doctorates and five senior faculty members whose teaching/industrial experience exceeds 35 years. Many of the teaching faculty are members of professional bodies of national repute such as IEI, ISTE, IWRS, ICI, ISNT, ISSS, IAStructE, IGBC, etc. The department is equipped with excellent laboratory facilities and is dedicated to offering hands-on practical orientation to the students. In addition to quality teaching and curricular input, the department is active in co-curricular and extra-curricular activities for the benefit of the students. The department has initiated student chapters of Institution of Engineers India (IEI), Indian Green Building Council (IGBC) and Indian Association of Structural Engineers (IAStructE). The student chapters actively support the department in organizing technical events, industrial visits, workshops and conferences for academic growth. The notable events are Two day National Conference on "Recent Trends in Structural Engineering (RTSE-2017)" and two day Industrial Workshop on "Civil Engineering Technologies – Industrial Practices (CETIP-2018)". The department has MoUs with NGOs and industries for training and professional enrichment of the students.

Dr. Akshay S.K. Naidu
Head (Civil Engineering), MCET

Department of Computer Science and Engineering

The Department of Computer Science and Engineering was established in the year 2008 with an intake of 60 and subsequently enhanced to 120 in 2010. The department offers a 4 year degree programme in CSE. The department constitutes a group of energetic, experienced and well qualified faculty from industry and academia. The department houses state-of-the laboratories providing hands-on training and thus encouraging them to build major and minor projects. The alumni of the department are well placed in core companies and MNCs.

The department instills quality education with holistic development. The students are encouraged to train and update their technical skills through various in-house trainings, knowledge transfer workshops, value added courses and project exhibitions. The department emphasizes a student - centric and friendly learning environment by systematically balancing academics and activities. The staff and students always work in tandem in organizing the various college level activities and technical fests. The relentless efforts of staff have helped the department in earning a good name & fame in a short span of time.

Vision: The Vision of the department is to provide leading programs in computer science whose graduates are recognized as innovative and well-prepared computing professionals.

The mission of the department is to strive for excellency by devising technical rich programs, which are ought to improve the caliber of our students To bridge the gap between industry and academia, the department has MOUs with various organizations like Oracle Corporation, Vee Eee Technologies Solution Pvt Ltd and SM MICRRO SYSTEM, Chennai.

Mrs. Lavanya Pamulaparty is working as Head of Department from December 2009. She is currently pursuing Ph.D. in Computer Science & Engineering from Dept. of CSE, College of Engineering, JNTU Hyderabad. She has 15 years of teaching experience in various reputed engineering colleges in Hyderabad. She has published more than 11 research papers in national and international conferences and journals..She has conducted various workshops, faculty development programmes, seminars and conferences.

Mrs. P. Lavanya
Head (CSE), MCET

Department of Electrical and Electronics Engineering

The Department of Electrical and Electronics Engineering has been established in the year 2008, with an intake of 60 students for the undergraduate B.E course, with an objective of imparting quality education in the Electrical and Electronics Engineering field.

The Department has 11 regular faculty members who are highly experienced and actively involved in research. The Department is equipped with state-of-art equipment and qualified technical staff. Apart from regular academic activities, the department faculty is involved in various professional activities like publishing their research findings in prestigious conferences and journals.

The department encourages the students in conceptualizing, implementing and participating in the various student Workshops,Guest Lectures and Industrial Internships to hone their technical skills. The department regularly organizes Industrial Visits to Electric Loco Shed South Central Railways, Central Power Training Institute, various Substations, HINT Transformer Manufacturing Company and many organizations related to the Electrical Engineering.

The department organizes events like various events like Paper Presentations, Poster presentations, Technical Quiz and Project Exhibitions to motivate the students to improve their technical and communication skills. The students of 2016 batch have undertaken a solar project to power our Power Electronics Lab thereby saving energy and is successfully powering our lab since then. The Department has MoU with ISIE (Imperial Society of Innovative Engineers) for undertaking innovative projects in equipment development which could lead to final year academic projects.

The department is proud of having achieved the first university gold medal for our college by Mr. Sachin Dharmini of 2013 batch who is presently working in Indian Railways after securing 8 th rank in IES. The alumni of the department are placed in core companies and MNCs.

The department is a student friendly department providing ample opportunity for student-teacher interaction through mentoring.

Mrs. Y. Mastanamma **ME(IDC),MTECH(CS), (Ph.D).**
Head (EEE), MCET

Department of Electronics and Communication Engineering

Electronics and Communication Engineering was established in the year 2008 with an intake of 60 and subsequently enhanced to 120 in 2010. The present student strength is 300 and faculty strength is 25. The department constitutes a group of energetic, experienced and well qualified faculty from industry and academia.

Electronics and Communication Engineering being one of the fastest growing disciplines among all Engineering domains, it deals with core courses in Electronic devices and circuits, Electromagnetics, Digital Electronics, Signals and systems, Communication Engineering, Microprocessors and microcontrollers, Automatic control systems, and Digital signal processing etc. The department houses state-of-the laboratories providing hands-on training and thus encouraging them to build major and minor projects. The alumni of the department are well placed in core companies and MNCs.

The department instills quality education with holistic development. The students are encouraged to evolve with the latest technological advancements through various in-house trainings, knowledge transfer workshops, value added courses, expert lectures and project exhibitions. They are motivated to improve their communication & written skills through special trainings, also to participate in extra-curricular activities, sports etc. The students organize various activities under IETE, IEEE AND TECHSPACE clubs. The department publishes monthly magazine named PEACE- Power of Electronics & Communication Engineering covering both technical and non-technical domains.

The department emphasizes a student-centric and friendly atmosphere by systematically balancing academics and activities. The staff and students always work in tandem in organizing the various college level activities and technical fests. The relentless efforts of staff have helped the department in earning a good name & fame in a short span of time.

Dr. N.H. Shobha Reddy
Head (ECE), MCET

Department of Business Management

Greetings from the Department of Business Management !

The MBA course at MCET was started from the A.Y:2009-10. Our department has emerged as one of the vibrant segments of our burgeoning MCET located in the very heart of the city of Hyderabad. Right from its inception the department has been playing a key role in imparting quality education to the student community. Our college is approved by AICTE and we are affiliated to Osmania University. Hence the curricula and syllabi of the two year fulltime MBA course offered with an intake of 60 students, is as per the CBCS of Osmania University norms. The specializations offered in Finance, HR and Marketing enables students in acquiring cross- functional knowledge. We provide case-based learning methods and impart pedagogy on par with premier institutions of the nation. The students have the delight of an environment friendly sprawling Wi-Fi campus, with state of the art infrastructural facilities, which include well-equipped computer labs, spacious library with access to online, and off-line national & international journals, centrally air-conditioned Seminar Hall with the latest facilities, well-structured playground and the list goes on.

The department has the strength of well-qualified, experienced and diligent faculty members who are committed in providing highest standards of education and excellence to the students. This is the reason we are able to produce 100% results in academics consistently. As we believe in continuous learning and growth, our dynamic DBM team strives towards excellence by organizing various programs for students and faculty. Particularly for the students, regular industrial visits are scheduled as part of the institute-industry interface. We have to our credit for the conduct of national level students' activities like Annual Fests, Budding Manager of Telangana, Meth-Honcho 2012, Seminars, Workshops and FDPs for faculty of MCET and of sister concerns.

Our MBA students have brought laurels to our college by winning the Badminton inter-college tournament conducted by OU and also cricket matches, Tennis tournaments at national levels. This is a testimony that for the overall development of the students, we encourage our students to participate in inter-college competitions at both the state and national levels. The department has the honor and pride in incubating the idea, taking initiative and bagging the '**Dewang Mehta National Education Award 2017**' for the college. This is a testimony and just tip of the iceberg in our pursuit of imparting quality education for our students. Spectacular achievements have been made by working with our core value of '**Unity in Diversity**' and with the contribution at the optimal potential by all our stakeholders, sky is our limit!

Mrs. Rani Rajan
Head (DBM), MCET

Department of Mechanical Engineering

The Mechanical Engineering Department was established in the academic year 2009-2010. Currently the department offers one under graduate program, B.E in Mechanical Engineering, with an intake of 120 and one Post Graduate Program, M.E with specialization in CAD/CAM with an intake of 18 seats.

The department is headed by Dr. A. Rajasekhar and has a team of 23 highly qualified, motivated and experienced faculty with 4 doctorates (Ph.D.) and rest are with M.E./M.Tech qualification in various areas of specializations. Majority of the faculty are having varied experience of industrial, teaching and research, which help to serve the students in exposing them to industrial and research environment.

The department is associated with professional bodies such as Society of automotive Engineers (SAE), Indian Society for Technical Education (ISTE) under which various activities are being taking place. The Department has MOU's with many organizations like ISIE (Imperial Society of Innovative Engineers), RAMTECH manufacturing industries and Sri Venkateswara Industries, Balanagar, Hyderabad etc.

The department organizes various student level technical events regularly, which include workshops, guest lectures, industrial visits and technical seminars to expose the student's inherent talent and skills. The department also organizes events like Faculty Development Programs (FDP), conferences and workshops to expose the faculty to latest technologies.

The department also conducts various certification courses in advanced technologies such as CAD / CAM in association with reputed professional training institutes.

The Department is recognized as "RESEARCH CENTRE" by the Osmania University in the month of March 2018.

Dr. A. Rajasekhar
Head (Mechanical Engineering), MCET

CONTENTS

Civil Engineering

Computer Science Engineering

Electronics and Communication Engineering

Electrical and Electronics Engineering

Mechanical Engineering

Information Technology

Master of Computer Applications

Master of Business Administration

Methodist College of Engineering and Technology

(Affiliated to Osmania University)

Abids, Hyderabad, Telangana, India

2nd International Conference on Paradigms in Engineering and Technology

ICPET-2018

December 28-29, 2018

UGC APPROVED JOURNAL

refine your research SCOPUS

GRENZE

i-manager Publications

CONFERENCE SCHEDULE

DAY-1 (DECEMBER 28, 2018), Friday

Timings	Scheduled Program
8.30 AM to 9.30 AM	Registrations
9.30 AM to 11.00 AM	Inauguration
11.00 AM to 11.15 AM	High Tea
11.15 AM to 12.15 PM	Plenary Talk by Keynote Speaker-I
12.15 PM to 1.15 PM	Plenary Talk by Keynote Speaker-II
1.15 PM to 2.00 PM	Lunch
2.00 PM to3.00 PM	Technical Lecture-I
3.00 PM to 4.00 PM	Paper Presentations
4.00 PM to 4.15 PM	Tea Break
4.15 PM to 5.00 PM	Paper Presentations

DAY-2 (DECEMBER 29, 2018), Saturday

Timings	Scheduled Program
9.30 AM to 10.30 AM	Plenary Talk by Keynote Speaker-III
10.30 AM to 11.30 AM	Plenary Talk by Keynote Speaker-IV
11.30 AM to 11.45 AM	Tea Break
11.45 AM to 12.30 PM	Technical Lecture-II
12.30 PM to 1.30 PM	Paper Presentations
1.30 PM to 2.15 PM	Lunch
2.15 PM to 3.00 PM	Technical Lecture-III
3.00 PM to 4.00 PM	Paper Presentations
4.00 PM to 4.15 PM	Tea Break
4.15 PM to 5.00 PM	Valedictory Function

PAPER ID: EEE201802

Experimental Investigation on the Influence of Humidity on PV Panel Performance

Abhishek Kumar Tripathi[1], Mangalpady Aruna[2], Ch.S.N. Murthy[3] and Bodapati Prasad[4]
[1,4] A.K.S. University, Satna, India
Email: abhinitrkl12@gmail.com, drbodapati@yahoo.com
[2,3]National Institute of Technology Karnataka, Surathkal, India
Email: arunamangalpady@gmail.com, chsn58@gmail.com

Abstract: The performance of PV panel is directly influenced by the surrounding environment. Among various environmental parameters, humidity is one of the parameters that affect the performance of PV panel. Therefore, in this paper an attempt is made to study the effect of relative humidity on the performance of PV panel. This study demonstrated that the increase in humidity level has a negative relation with the performance of PV panel. There was a 35.82% reduction in the output power of the PV panel with the increase in humidity level from 65.40% to 98.20%.

***Index Terms*—Humidity, output power, PV panel and environment.**

ISSN: 2395-5295 (Online), 2395-5287 (Print)
Journal: Grenze International Journal of Engineering and Technology (GIJET)

PAPER ID: EEE201805

Performance Analysis of Sliding Mode Controller Fed PMSG Based Wind Energy Conversion System

Y. Mastanamma[1], Dr. D. Subbarayudu [2]
[1] Research Scholar at Rayalaseema University, Kurnool, Andhra Pradesh and HOD-EEE/Associate Professor at Methodist College of Engineering and Technology, Abids, Hyderabad.
[2] Research Supervisor at Rayalaseema University, Kurnool, Andhra Pradesh, India.
Email Id: mastanammaeee@gmail.com

Abstract — This paper proposes a Sliding Mode Controller (SMC) for a variable speed, Wind Energy Conversion Systems (WECS) with Permanent Magnet Synchronous Generator connected to a local load. The proposed control strategy is employed to cut the chattering impact and to improve THD in comparison with typical systems. In this work a five level inverter is used. The performance of this control strategy is tested using MATLAB/Simulink for a 6 kW wind turbine.

Index Terms-WECS, PMSG, Five level inverter, Sliding Mode Controller (SMC)

ISSN: 2230-7184 (Online), 0973-2632 (Print)
Journal: i-manager's Journal on Future Engineering and Technology (JFET)

METHODIST COLLEGE OF ENGINEERING AND TECHNOLOGY, HYDERABAD.

(Affiliated to Osmania University & Approved by AICTE)
King Koti, Abids, Hyderabad – 500001

2nd INTERNATIONAL CONFERENCE
ON
PARADIGMS IN ENGINEERING & TECHNOLOGY (ICPET-2018)

Certificate

This certificate is issued to Prof./Dr./Mr./Ms. K. Anuradha
of H & S Dept for attending/presenting a paper as a **author/co-author** entitled Electrical Properties of Polyvynyl Alcohol doped with Kaolin

during the **2nd International Conference On Paradigms in Engineering & Technology (ICPET-2018)** held on 28th & 29th December 2018 at Methodist College of Engineering & Technology, Hyderabad as a part of **Decennial Celebrations.**

Convener | Dean | Director