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DESIGN AND ANALYSIS OF A TATA ACE DIFFRERNTIAL GEAR AND DRIVE SHAFT

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Abstract: *The reason for this task is to build up the model of a slope outfit gathering and to decide the impact of cross section equip tooth stresses and relocation. In exhibit advertise, the materials utilized for gears producing are Cast Iron and Cast steel. In this examination correlation was done between Ni-Cr steel and steel. The plan is done in Solid works programming and investigated utilizing ANSYS work seat. The legitimization has been finished by considering a full writing audit. And furthermore, this venture manages outline and examination of a drive shaft. Amid the transmission of energy from the motor to the differential rigging box of a back wheel drive vehicle there is an issue of disappointment after long keep running of the vehicle because of low particular firmness and quality of the material. The drive shaft ought to be competent to give smooth and continuous power transmission at different rates required by the vehicle. A solitary piece drive shaft can be favoured in introduce advertise rather than a two piece drive shaft with the goal that the heaviness of the drive shaft can be decreased. By and by utilized materials in the market for assembling are Cast Iron, Cast Steel. The reason for this task is to plan the drive shaft made of Ni-Cr steel and contrast it and steel material. The outline is done in Solid works programming and dissected utilizing ANSYS*

Keywords: *Differential gear ,Drive shaft, Ni-Cr, Ansys,* Solid *works*

I. Introduction

A differential is a gadget used to transmit the power from motor to the back wheels. In autos the differential permits each of the driving street wheels to pivot at various rates, while for most vehicles providing speed with torque to each of them. A vehicle's wheels rotate at different paces, fundamentally when turning corners. The differential is proposed to drive a few wheels with approach torque while empowering them to rotate at different speeds .While cornering, the inner wheel needs to travel a shorter distance than the outer wheel, so with no differential, the result is the internal wheel turning and moreover the outside wheel dragging, and this results in troublesome dealing with and mischief to tires on boulevards and strain on entire drive system. The differential is a piece of the last drive get together and its goal is to pivot the inward wheels at various rates at whatever point the vehicle takes turn from straight way and furthermore to permit break even with torques on each of the wheels notwithstanding when they are pivoting at various velocities .Car wheels spin at different speeds, especially when turning. You can see from the animation that each wheel travels a different distance through the turn, and that the inside wheels travel a shorter distance than the outside wheels. Since speed is equal to the distance traveled divided by the time it takes to go that distance, the wheels that travel a shorter distance travel at a lower speed. Also note that the front wheels travel a different distance than the rear wheels. For the non-driven wheels on your car the front wheels on a rear-wheel drive car, the back wheels on a frontwheel drive car this is not an issue. There is no connection between them, so they spin independently. But the driven wheels are linked together so that a single engine and transmission can turn both wheels. If your car did not have a differential, the wheels would have to be locked together, forced to spin at the same speed. This would make turning difficult and hard on your car: For the car to be able to turn, one tire would have to slip. With modern tires and concrete roads, a great deal of force is required to make a tire slip. That force would have to be transmitted through the axle from one wheel to another, putting a heavy strain on the axle components. The propeller shaft or a drive shaft is a unit of the vehicle transmission framework that associates the apparatus box yield shaft to the information shaft of the differential at the back pivot. It transmits the power from the motor, grasp and rigging box to the driving wheels of the vehicle through conclusive drive and differential unit. It needs to perform two capacities. One is to transmit movement at a point which is differing as often as possible and the other is to suit changes long between the apparatus box and back pivot. Because of longer length and high speeds, the propeller shaft tends to vibrate at certain basic velocities.

II. Design of Differential Gear

In autos and other wheeled vehicles, the differential enables each of the driving wheels to turn at unmistakable rates, while for most vehicles giving measure up to torque to each of them. A vehicle's wheels rotate at various paces, basically when turning corners. The differential is planned to work a few wheels with same torque while enable them to turn at different rates. In vehicles without a differential, for instance, karts, both driving wheels are constrained to turn at the identical speed, all around an ordinary rotate driven by an essential chain drive

framework. While cornering, the internal wheel needs to travel a shorter detachment than the outer wheel, so with no differential, the result is the inward wheel turning and also the outside wheel dragging, and this results in troublesome moreover, whimsical managing, mischief to tires and boulevards, and strain all in all drive get ready. The Differential transmits mechanical imperativeness from a prime mover to a yield device. It moreover changes the speed, course of mechanical essentialness. Differential gearbox is used when quick, far reaching power transmission where clatter lessening is basic. A differential is a gadget, as a rule yet not really utilizing gears, fit for transmitting torque and pivot through three shafts, quite often utilized as a part of one of two courses: in one way, it gets one info and gives two yields this is found in many autos and in the other way, it joins two contributions to make a yield that is the whole, distinction, or normal, of the sources of info. In autos and other wheeled vehicles, the differential permits each of the driving street wheels to pivot at various paces, while for most vehicles providing break even with torque to each of them. The examination is led to check the best material for the apparatuses in the rigging box at higher speeds by investigating stress, relocation and furthermore by considering weight decrease. Outline counts are done on the differential of TATA ACE by shifting materials and velocities. Solid Works records utilize the Microsoft Structured Storage document arrange. This implies there are different records implanted inside each SLDDRW, SLDPRT, SLDASM document, including review bitmaps and metadata sub-documents. Different outsider devices can be utilized to separate these sub-documents, in spite of the fact that the sub records by and large utilize exclusive parallel record designs. In this design different parts have designed in order to make the assembly and material Some of the workbenches which used in the making of differential and the propeller shaft.

Sketcher ,Part design(features),Assembly ,Design resources, Rendering

Paper Aim

To design a gear box and propeller shaft housing using solid works To find out the natural frequencies of gearbox and propeller using ANSYS work bench. To find out the stress, strain and torque generated in gearbox and propeller shaft under different conditions with steel and Ni-Chrome materials

Analysis work**:** The paper is divided into two types:

1)Static Structural Analysis2)Harmonic Analysis

Design of different parts of a differential gear and the propeller shaft**.**

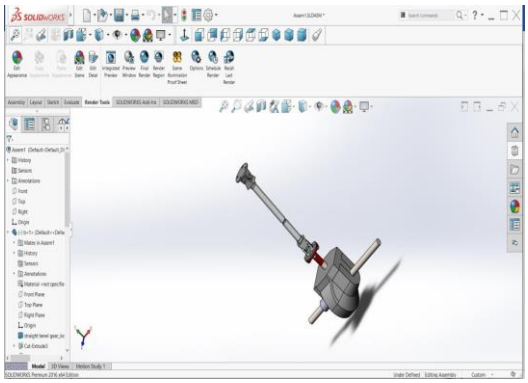


FIG:1Assembly of a differential and propeller shaft.

FIG:2 Rendered image of the differential

III Static Analysis

performing linear static structural analyses in Simulation will be covered Geometry and Elements, Assemblies and Contact Types ,Analysis Settings, Environment, including Loads and Supports, Solving Models, Results and Post processing

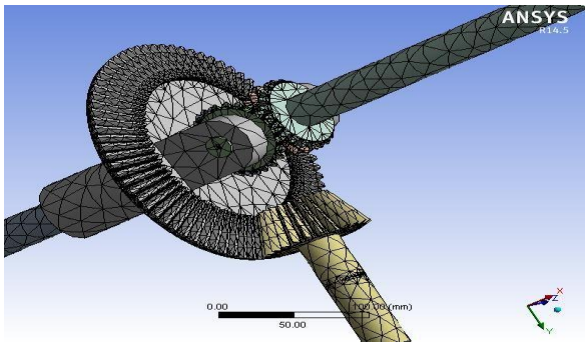


FIG:3Meshed model

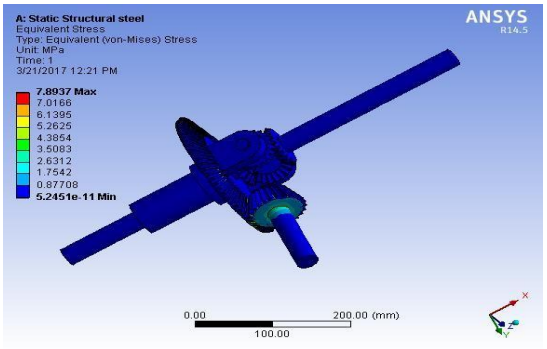
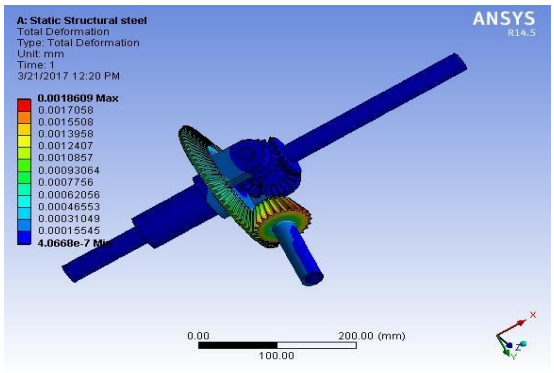


FIG:4Vonmises stresses



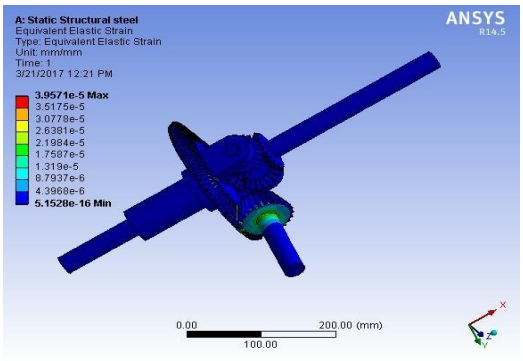
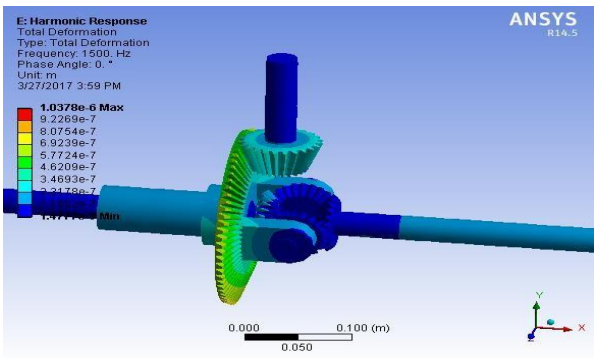


FIG:5Total Deformation FIG:6Elastic strain

IV.Harmonic Analysis

Any sustained cyclic load will produce a sustained cyclic response (a harmonic response) in a structural system. Harmonic response analysis gives you the ability to predict the sustained dynamic behavior of your structures, thus enabling you to verify whether or not your designs will successfully overcome resonance, fatigue, and other harmful effects of forced vibrations .Here in this paper maximum frequency 1500 HZ is applied on it.



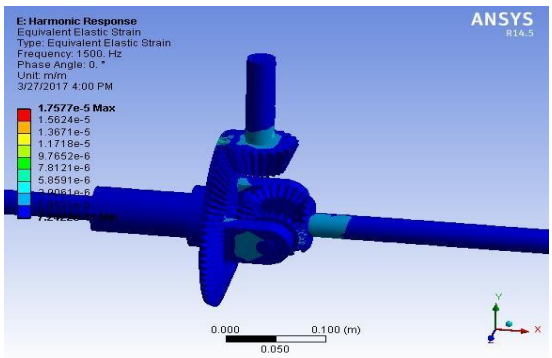
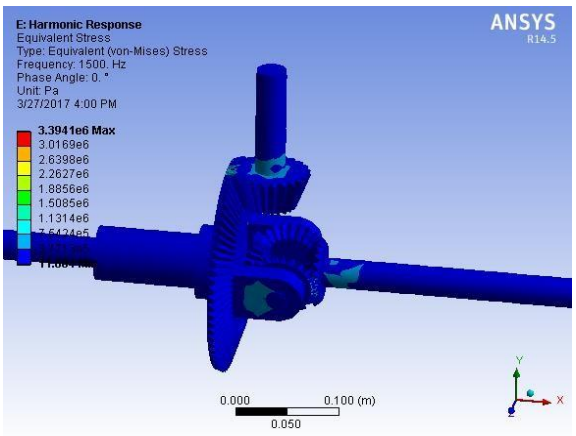


FIG:7Total Deformation FIG:8Elastic strain



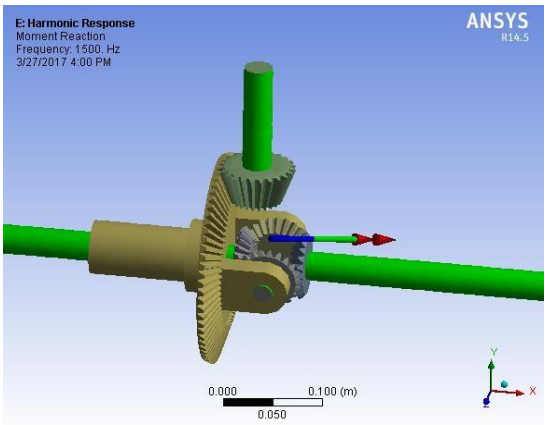


FIG:9Vonmises stresses FIG:10 Moment reaction

V. Modal analysis of a propeller shaft with steel and Nickel chrome

Modal analysis is the study of the dynamic properties of structures under vibration excitation. Modal analysis is the field of measuring and analyzing the dynamic response of structures and or fluids uring excitation .Now a day's model analysis system is composed of 3 types:

1)Sensors such as transducers.2)Data acquisition system and an analog-to-digital converter front end.

3)Host personal computer to view the data and analyze it.

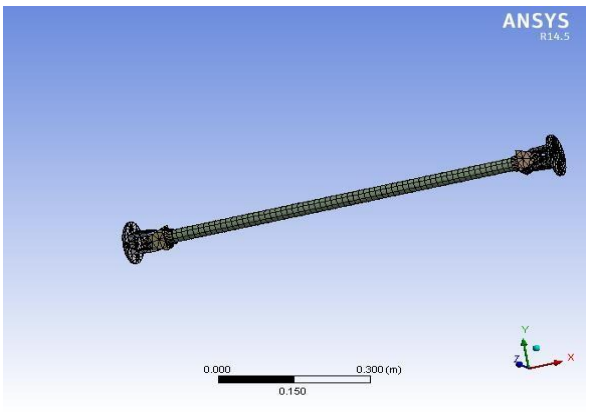


FIG:11Meshed shaft

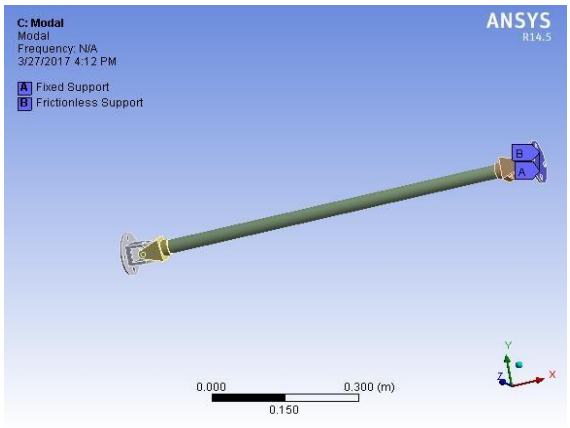


FIG:12Shaft with supports

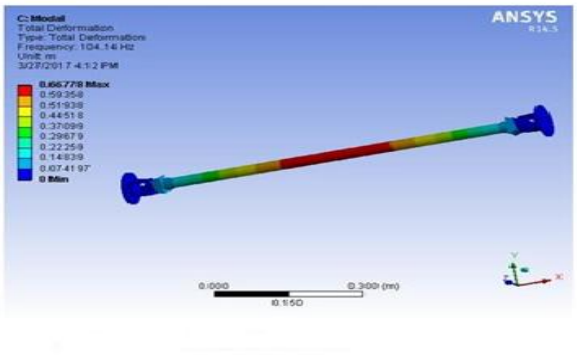


FIG:13 Total deformation of steel shaft

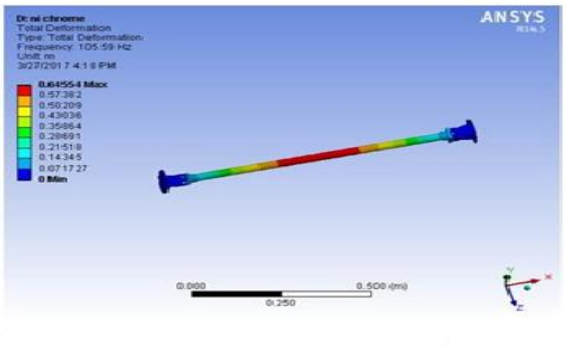


FIG:14 Total deformation of NI-Chrome

VI. Results and Conclusions

Differential gear-Static analysis		
	Steel	**Ni-Chrome**
Total deformation	0.0018609mm	0.0016917mm
Elastic strain	0.00003957	0.00003957
Vonmises stress	7.8937Mpa	7.8937Mpa
Differential gear –Harmonic analysis		
Total deformation	$1.037*10^{-6}$mm	$8.3*10^{-7}$mm
Elastic strain	$1.757*10^{-5}$	$1.39*10^{-5}$
Vonmises stress	3.39Mpa	2.95Mpa
Propeller shaft-Modal analysis		
Total deformation	0.0012516	0.0012288
Elastic strain	0.00088536	0.00082857
Vonmises stress	$1.71*10^{8}$N/mm^2	$1.78*10^{8}$N/mm^2

Tata ace is one of the most used commercial goods carrier vehicles in India. Due to application of excess load than the required, vehicle breaks down. one of the major problem customers of Tata ace are facing is sudden detachment of drive shaft from the rod connected to engine and differential.

Reasons of detaching shaft from the engine to the differential is when the load is applied on the carriage the torque and rotation speed is more from engine so the gears are slip and disengaged with contact gear and falls down

By theoretical comparison between steel and Ni-Cr steel, Ni-Cr steel is better in differential gear box and propeller shaft manufacturing because of its high strength. Though the cost of Ni-Cr is high, it has long life compared to Steel .With the help of this analysis the problem with the differential and shaft of the material can be changed so the problems can be rectified for Tata ace vehicle

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