

Design and analysis Light Weight Foldable cycle

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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.

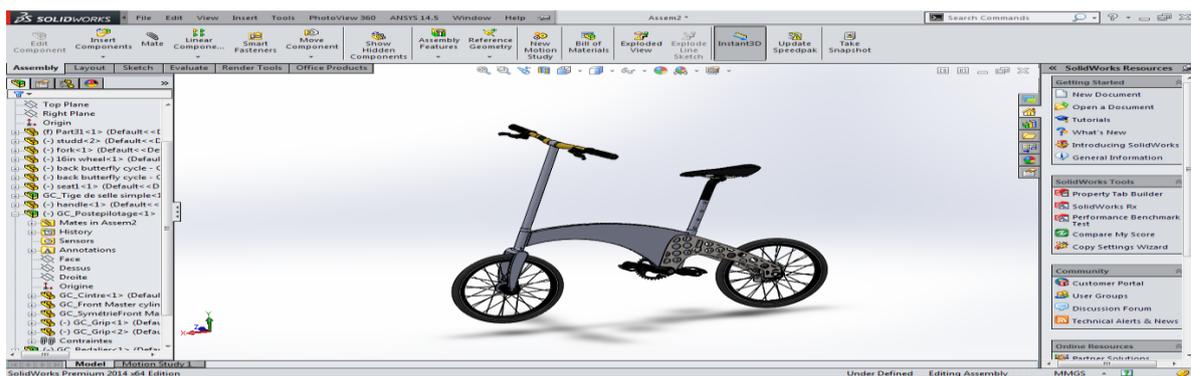


Fig:3 Assembly of cycle



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.

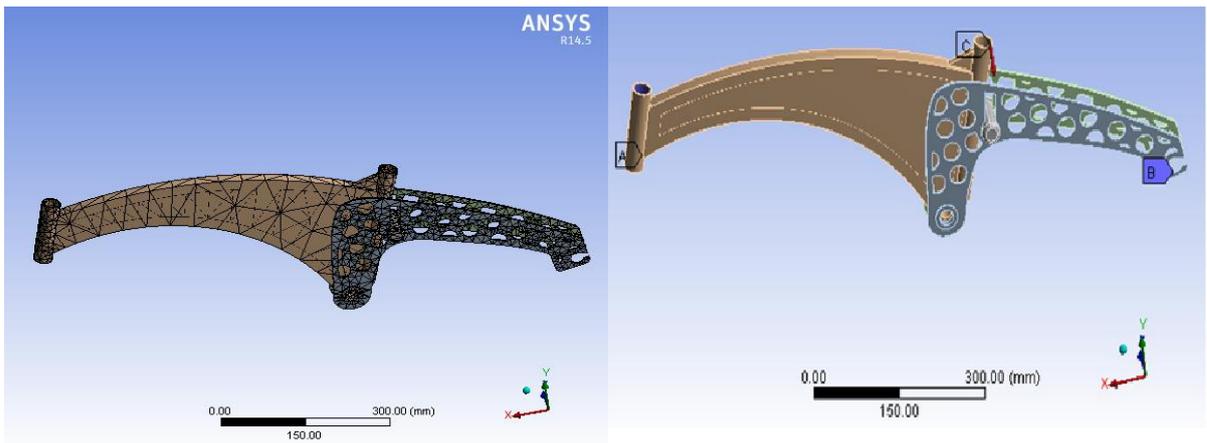


Fig:7 Meshing and Boundary conditions applied to the frame

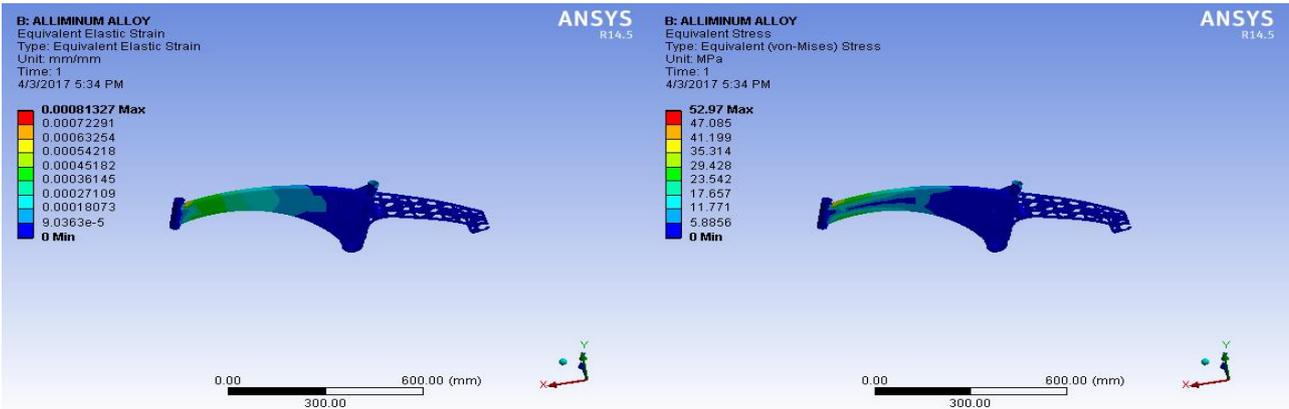


Fig: 8 Equivalent elastic strain and Vonnises Stress

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.

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