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"A SURVEY ON DESIGN AND ANALYSIS OF BIKE FRAME"

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ABSTRACT

Bikes are electric bikes and petrol engine bikes which are driven by the use of petrol as the source of fuel. Bikes are opted for its eco-friendliness and cost-effectiveness for transportation. In the present study, optimum design for an bike was modeled and analyzed for stress and failure rate for commercial purpose. Frame is backbone of the bike; it supports and holds the whole load. The main objective of the paper was to design and fabricate a light weight still strong, safe, and economical than the conventional ones. The material used is of AISI standard. The analysis comprised of static simulations and drop analysis for sudden impacts of all the components in the frame. It could be concluded that the design of the bikes was so fabricated that it could withstand impacts.

Key Words: *Design, Frame,bike, swing arm, Analysis, drop test..*

I. INTRODUCTION

The rise of demand and constantly increasing cost of petrol and diesel has been ruling India for ages; society needed a non-negotiable solution especially in India. Transportation is very important and in order to augment it, people started seeking transportation by different means of energy. Electric vehicles gave a breakthrough solution to satisfy the needs required thereby it started to flourish, by overcoming the hindrance [1]. Electric Bikes are two wheeler vehicles which uses electricity as the source of fuel. Electric motorcycles are noiseless, pollution free, zero-emission, and electrically driven. The operation and speed are controlled by the battery. To extend the variety of e-bikes and improve the production, fuel cells and petrol-electric hybrids could be introduced which are also in the verge of development and thus improving the efficiency of the electric drive system. The usage of electric bikes has turned out to be a solution for reducing pollution to a larger extent. To burgeon the sale of e-bikes it needs to be enhanced in quality, hence in the present study the e-bikes are designed with frame which is light in weight when compared to conventional bikes for the purpose of efficacy.

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Fig .1.1 Bike frame

II. Literature Review

C. H. Neeraja et. al. have finished the assessment on showed suspension layout for the bicycles. Showing had being done on a 3D exhibiting programming Pro/Engineer. To look at the nature of an edge, assistant assessment is finished by applying the wheel powers. Examination is done on the ANSYS programming. By having looked at the results, for different materials and stress regards saw to be in limit and not actually sensible limits confirming to prosperity of passenger.[1]

Teo Han Fuiet al. manages the Statics and Dynamics, Structural Analysis of a 4.5 Ton Truck Chassis, he asked about and chose the dynamic typical for the truck body. What's more, the mounting zone of the engine and transmission system is about the reasonable center point of the suspension first torsion mode where the effect of the central mode is less moderately. These characteristics are sufficient when contrasted with the yield nature of the body material and the resistance considered the case. [2]

S. Agostoni, A. et. al. they had endeavored to improve vibration execution of the rush by an investigation done while doing this assessment is for finding close by vibration modes. Technique made will have the choice to perceive the close by vibration modes grant to find if/when/how undercarriage parts' resonances are invigorated. [3]

Faconle et. al. the investigation is being done in this paper in the field of shortcoming assessment and the close by pressure – strain approach in the complex vehicular structures. The paper induces that the damage evaluation should be versatile from this time forward to manage a couple multiaxial shortcoming hurt standards.. [4]

Abhishek Sharm et. al. have arranged the significant vehicle outline and dismembered with the help of ANSYS-15.0. The TATA LPS EX suspension is used in the assessment for the helper examination of the generous vehicle outline with three unique composites mistreated having comparative conditions of the steel body.[5]

Jakub Smiraus et. al. They considered on the organizing of the bicycle and contemplated that the system with controlling geometry changes might be an initiating thought being developed of the 21st century bicycle case. The path alteration close by changes in wheelbase and ground breathing space of the bike open up various choices in the field of negative effects rule coming about in view of the dynamic qualities of bicycle movement.[6]

Haval Kamal Asker et. al ,had made examination and gone after the Stress Analysis of a Standard Truck Chassis during slanting on square using constrained segment method and he focused on the power and the nature of the packaging expect a significant activity in the truck's structure. He had been studing and dissecting using the Ansys pack programming. Furthermore, vibration modes and the redirection in the people from the skeleton have been researched during the stacking conditions.[7]

Cicek Karaoglu et. al. did the restricted part examination of a truck undercarriage. The examination showed that extending the side part thickness can reduce weights on the joint domains, anyway comprehend that the general load of the suspension edge increases. Using neighborhood plates just in the joint domain can similarly construct side part thickness. Subsequently, over the top heap of the skeleton edge is prevented.[8]

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Karaoglu . C. et. al. investigated pressure examination of a truck undercarriage with shot joints using FEM. Numerical outcomes exhibited that loads as a bit of hindsight part can be diminished by growing the side part thickness locally. Fermer et al inspected the depletion life of Volvo S80 Bi-Fuelusing MSC/Fatigue.[9]

Conle and Chu et. al. Investigated about exhaustion assessment and the local pressure – strain approach in complex vehicular structures.[10] Auxiliary headway of vehicle parts associated with sturdiness issues has been investigated by Ferreira et al Filho et. al. have inspected and propelled a skeleton plan for a harsh territory vehicle with the reasonable dynamic and fundamental behavior.[11]

III. PROBLRM STATEMENT

With the abusive conditions of mountain biking, bike riders require frames that can withstand significant forces, and have high fatigue lives. Aluminum is the material of choice for most bicycle companies when it comes to mountain bicycle frames, with other common materials being steel, titanium and carbon fiber. Aluminum has a favorable strength to weight ratio, and a lower cost compared to other materials used for bikes. However, when compared to these other materials, aluminum is more susceptible to fatigue failure at lower cycle counts and has a finite fatigue life. Fatigue failures that occur during typical usage of mountain bikes can have devastating effects for bikes manufacturers, resulting in expensive recalls, legal liabilities, and loss in product image.

IV. METHODOLOGY

Overview After defining the main objectives to investigate fatigue failures, the group determined it was necessary to obtain a physical bike frame to analyze and optimize. The group found a local bike company willing to donate two identical 6061-T6 aluminum prototype mountain bike frames for a fatigue investigation. The investigation not only met the objectives of the group, but also provided value for the local bicycle company by testing and validating the fatigue life of the prototype. The group devised an integrated FEA methodology to understand the fatigue behavior of the bicycle frame. The FEA methodology was based on the bike specific ASTM F2711-08 test standard. The methodology allowed the group to use computer simulation to predict the fatigue failure locations of the donated frames, and the cycles to failure in those locations. The FEA methodology was then validated using physical frame testing. A fatigue testing rig was built in-house to test one of the donated frames until failure. The second frame was sent out to an external testing facility to ensure the group obtained accurate fatigue testing data. The results between the physical frame testing were compared to the FEA methodology results to determine how well the FEA methodology agreed with actual testing. The fatigue crack on the tested frame at WPI was then fractographically analysed to obtain an understanding of the crack propagation. An optical microscope and a scanning electron microscope (SEM) were used to analyse the fracture. The analysis was compared and correlated to the observed crack growth rate. A point of origin was found using the SEM to determine exactly where and why the crack originated. After developing the FEA methodology, validating the methodology, and conducting the fractographic analysis, the group worked to optimize the material, heat treatment and geometry design of the frame. Changes were made to each of these characteristics of the frame to work to optimize the fatigue life. Alternative aluminum 5 alloys were investigated as well as alternative heat treatments of 6061 aluminum for the bicycle frame. Finally, modifications to the frame geometry were made to work to improve the fatigue life of the frame. The material, heat treatment and geometry modifications were then combined to result in a bike frame optimized for fatigue resistance.

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Methodology

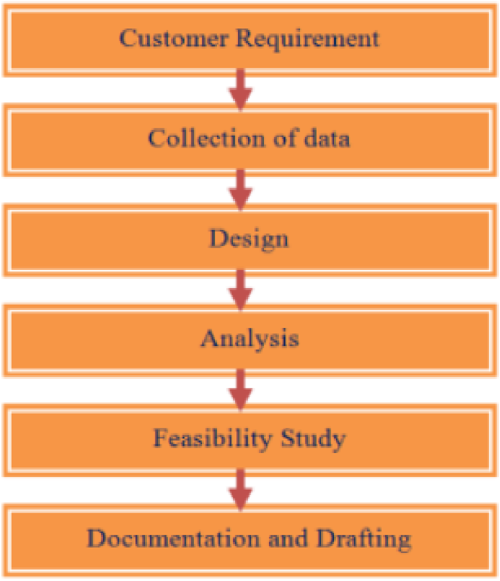

Fig.4.1 - Methodology

V. CONCLUSION

Three main objectives were followed to investigate fatigue failures in the front triangle of bike frames. These objectives work towards investigating the fatigue life and failures of aluminum bike frames. The first main objective involved using finite element analysis (FEA) to develop an integrated methodology to predict fatigue failure locations and fatigue lives at those locations. Fatigue failure locations and fatigue lives are critical considerations for bike frame design. The second objective of the project was to validate the FEA methodology using physical frame testing. Validating the FEA methodology with physical testing allows for determining whether the predicted fatigue failure locations and cycles to failure are accurate. The last main objective involved optimizing material, heat treatment and geometry to improve fatigue life. The material selection, heat treatment and geometry of a bike frame all have a significant impact on the fatigue failure locations, and cycles to failure.

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