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Structural Design & Analysis of Steering Clevis Joint of an ATV For Weight Reduction & Steering Stability

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Abstract— The weight of the vehicle is going on increasing due to additional luxurious and safety features. The increasing weight affects the performance of the vehicle. Clevis joints are mostly used as an extension to steering rack to drive the power of steering rack to the tie rods of the vehicle. There are various parameters that affects the connection of steering rack directly to tie rods. Hence clevis joint are used as an attachment to the rack which are able to change the position of the tie rods of an ATV accordingly control the necessary steering arm angle and conclusively tie rod angle with respect to the steering assembly . This paper is based on custom clevis joint. Typically design software CATIA & Solidworks is utilized to achieve the purpose. ANSYS is used for analyzing the component.

***Index Terms*— Clevis Joint**

I. Introduction

Steering clevis joint examination, guiding clevis joint was utilized as part for study. Clevis joint used as a part of steering system extension provided to the steering rack externally. The threads provided inside steering rack and tapping procedure done on the clevis joint providing the clevis joint and steering rack an mating platform .

To observe maximum amount of force that can be sustained by the joint and to provide maximum working efficiency & calculating braking force, load transfer during acceleration and braking etc. are applied on it static analysis is performed.

A. Shape optimization

All manufacturing enterprises strive to develop the optimized product commonly by reducing the weight while ensuring they produce cost effective products that meet their design functionality and reliability. Structural optimization tools like topology and shape optimization along with manufacturing simulation are becoming attractive tools in product design process. These tools also help to reduce product development time. Objective of this investigation is to reduce weight of steering clevis joint and analyzing the components.

II. LITERATURE SURVEY

Rajkumar Roy et. al. (2008) attention on late ways to deal with mechanizing the manual enhancement procedure and the difficulties that it introduces to the designing group. The study recognizes adaptability as the significant test for configuration advancement systems. GAs is the most prominent algorithmic enhancement approach. Huge scale streamlining will oblige more research in topology plan, computational force and productive streamlining algorithms.[4]

S. Vijayaranganet.al.(2013) utilizes the distinctive material than normal material for improvement of directing knuckle. They utilize Metal Matrix Composites (MMCs) as it can possibly meet requested configuration necessities of the car business, contrasted and traditional materials. Basic examination of controlling knuckle made of substitute material Al-10 wt% Tic was performed utilizing business code ANSYS. It is found from the examination; the knuckle strut locale has most extreme anxiety and avoidance amid its life time. The outcomes got from numerical examination and exploratory testing utilizing particulate fortified MMCs for controlling knuckle with a weight sparing around 55% when contrast and right now utilized SG iron.[5]

Rajeev Sakunthala Rajendran et. al. (2013) talk about the procedure of outlining a light weight knuckle sans preparation. The outline space is recognized for the knuckle and in this manner a configuration volume fulfilling the bundling necessities is made from it. Utilizing Opti Struct, topology improvement is performed on the outline volume to determine the ideal burden way needed for the significant burden cases. Hypermorph is utilized to make the obliged shape variable and Hyper Study is utilized as streamlining agent. The procedure of utilizing Topology streamlining for burden way generation& Parametric study utilizing shape advancement, diminishes the outline emphasis and middle of the road idea models and there by decreases the configuration process duration.

In Paper Structural Analysis Of Steering Knuckle For Weight Reduction Purushottam Dumbre et al(2013) finished up thatTopology advancement can be utilized to diminish the heaviness of existing knuckle segment by 11% while meeting the quality necessity, with restricted outline space given with or without change in material properties.

III. DESIGNING A CAD MODEL:

CAD model of clevis joint was produced in 3D demonstrating programming Solidworks. It consists of steering rack and pinion arranged with clevis joint. Clevis joint mostly relay on directing and holding geometry.

IV. MATERIAL SELECTION:

EN8 was selected as a standard material for clevis joint as it holds the proper strength and mass required for the assembly

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to hold firm position and successfully pass the tests under certain high loading conditions.

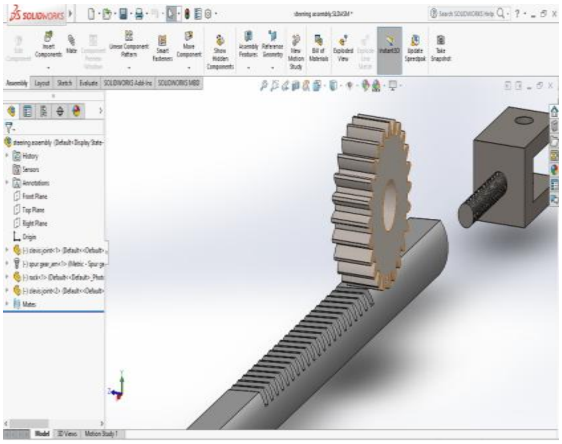

Fig 1: Steering assembly with Clevis Joint

Fig 2.Both Clevis joints inserted in rack Material: EN8

Mass = 0.83 pounds

Volume = 9.66 cubic inches

Surface area = 76.88 square inches

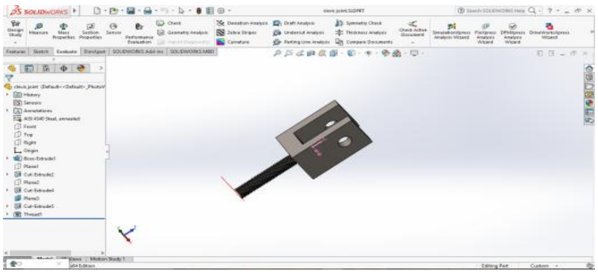

Fig 3.Single Clevis Joint Designed

Mass = 125.58 grams

Volume = 15997.23 cubic millimeters

Surface area = 7673.47 square millimeters

V. MESHING

Meshing is done in Ansys software using standardcoarse meshing techniques.

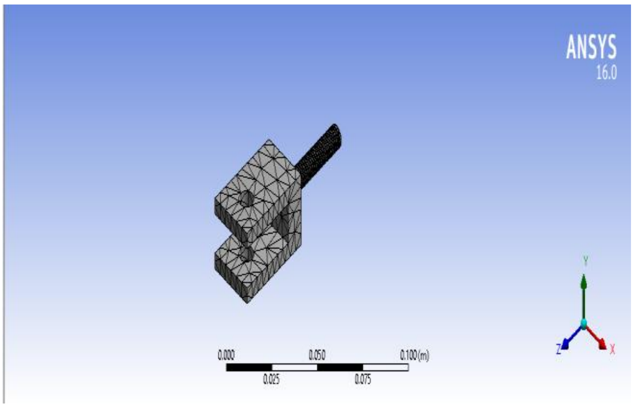

Fig 3

Material: EN8
Nodes:12027
Elements:6007

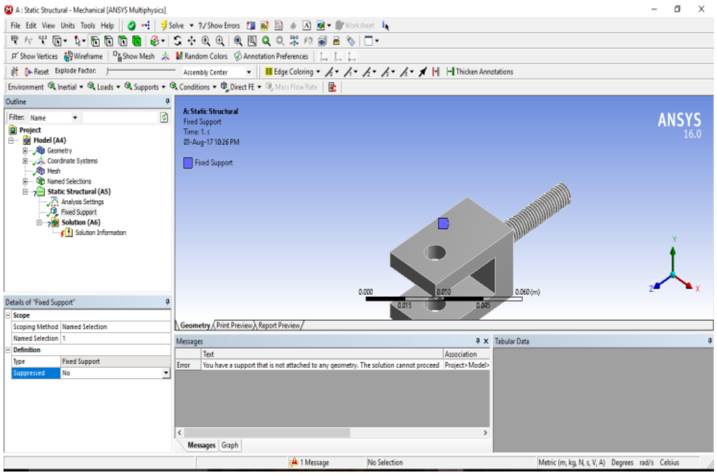

Fig 4: Fixed Support Provided

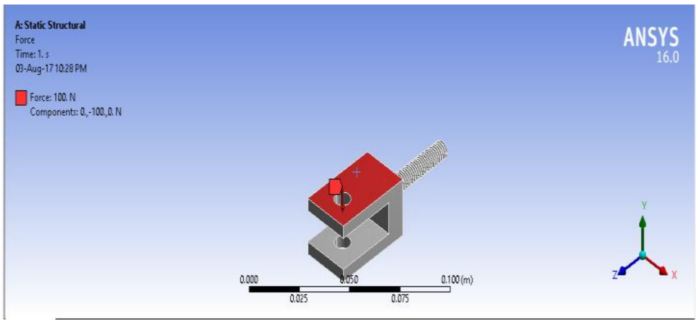

Fig 5:Force Applied Sustained

VI. SUMMARY OF RESULTS

Optimized Mass of component: 0.250kg
Optimized Stress: 10 MPA

VII. CONCLUSION

From above reports it is clear that the design is safe to use under all loading-unloading conditions and analysis prove that the design is not affected by the fixed supports applied over the clevis joint.

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