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DESIGN AND ANALYSIS OF STEERING KNUCKLE FOR WEIGHT OPTIMIZATION BY USING FEA

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Abstract: Steering knuckle is the major component of a vehicle, which, connects the suspensions systems, braking system and the steering system to the chassis of the vehicle. The steering knuckle provides motion to the desired directions with the help of the steering system. A steering knuckle should have high Precision, durability and less weight. The purpose of this paper is to design a knuckle which is less in weight and has a better performance and comfort steering effort. First step, the steering knuckle is designed with the help of Auto CAD (by using reverse engineering method to convert the passenger vehicle knuckle into 3D model) design and estimating the actual loads, which are acting on the component, material (Grey cast-iron) properties, boundary conditions and loading conditions.

Key Words: Steering knuckle Design (Auto CAD), static structural analysis (Ansys.14.0), FEA.

INTRODUCTION:

Steering knuckle is the critical component of the vehicle which is linked with suspension system, braking system and steering system. It allows steering arm to turn the front wheel and it also supports the vertical weight of the vehicle. The steering knuckle is the connection between control arms, tie rod or steering arm and braking callipers and these are also connected at the suspension system in this, wheel hub is fixed with steering knuckle with the help of bearing. The main function of steering knuckle is to convert linear motion of the tie rod into the angular motion of the stub axle in the automobile industry. The requirement of properties of steering knuckle that must be strong, inflexible and light as well as possible. When steering is turned by drivers. Half portion of the steering knuckle is turned by drivers. Half portion of the steering knuckle component is subjected to tensile load and another half portion of steering knuckle component is subjected to compressive load and due to this rotation of wheel. Steering knuckle is subjected to torsion load. steering knuckle is that structure on the wheel hub, to which the tie rod ends of the track rod transfer motion to the wheels.

LITERATURE REVIEW:

It is variously called a steering knuckle, spindle, upright or hub, as well. Tie rod ends and the track rod are the links of the steering system of the vehicle, which are designed according to a particular steering geometry among the off-road vehicle structural components, the steering knuckle is one of important & non-standard component which is connected to steering, suspension and brake to the chassis of vehicle. It plays a crucial role in minimizing the vertical and roll motion of the vehicle body, which implies a poor passenger experience, when a vehicle is driven on a rough road. The steering knuckle accounts for maximum amount of weight of all suspension components, which requires high necessity of weight reduction. Under operating condition, it is subjected to dynamic forces transmitted from strut and wheel on cars with MacPherson strut suspension systems, the steering knuckle has an opening to allow connection of the axle shaft to the wheel hub and bearing assembly.

MATERIALS:

PARTS OF THE STEERING KNUCKLE:

The part of the steering knuckle component are given below,

- Upper control arm
- Lower control arm
- Steering arm
- Brake caliper