Fatigue or Durability Analysis of Steering Knuckle

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Abstract—the purpose of the study of this thesis is to discuss analysis the acting force upon the steering knuckle while in track or random load for a vehicle. Steering knuckle is main important part in the vehicle because that requires lots of attention in selection because once it is damaged then it have to replace with the new one.

Structural Components such as a steering knuckle might be strong enough to withstand a single applied load. But what happens when the part operates over and over, day after today? To predict component failure in such cases requires what’s called fatigue or durability analysis.

For our purposes, a constant or static load does not cause failure. What counts is the impact of working or fluctuating loads. Failures, or fractures, take place when cracks get so large that remaining material can no longer endure stresses and strains. In classic structural analyses, failure predictions are based solely on material strength or yield strength. Durability analysis goes beyond this, evaluating failure based on repeated simple or complex loading.

I. INTRODUCTION
The assumption that loads tug in one direction is a simplification that works well, to a point. In the real world, however, loads are simultaneously applied in several directions, producing stresses with no bias to a particular direction. These stresses are called multiaxial. In order to accurately calculate fatigue damage, analyses must identify multiaxial stresses and use appropriate algorithms. Steering knuckle is one of automotive that frequently carries load from several directions. The wheel spindle fits through a hole in the center. Each circumstances of the road give the different impact to the steering knuckle. If the user driving the vehicle over cobblestone slalom, the applied loads to the steering knuckle through the strut mount, lower ball joint, steering rod tie, and wheel axis will create a multiaxial load condition. Multiaxial fatigue analysis is important to analyze all the pivot point in this part. This research will be based on this multiaxial stresses that act on steering knuckle part during the unstable road. In that situation, random load are applied to these pivot.

II. OBJECTIVE
To make a research and Fatigue or Durability analyse of load that acting on steering knuckle of a vehicles in motion.

III. INTRODUCTION OF STEERING KNUCKLE
A steering knuckle is a stub axle that is used as a connection point between the tie rod and wheel. Steering knuckles also connect the lower and upper ball joints in A frame vehicle suspensions. Disk-brake systems use steering knuckles as a brake-caliper mount.

In automotive suspension, a steering knuckle is that part which contains the wheel hub or spindle, and attaches to the suspension components. This is called steering knuckle. The wheel and tire assembly attach to the hub of the knuckle where the tire/ wheel rotates while being held in a stable plane of motion by the knuckle/suspension assembly.

IV. TYPES OF STEERING KNUCKLE
Steering knuckles can be divided into two main types
1) Attach with a hub
2) Attach with a spindle (with the axis or shaft)

V. DEFINITION
A forging that usually includes the spindle and steering arm, and allows the front wheel to pivot. The knuckle is mounted between the upper and lower ball joints on a SLA suspension, and between the strut and lower ball joint on a MacPherson strut suspension.

Fig. 1:
The steering knuckle provides an attachment point for the tie rod to the wheel. The steering knuckle also provides an attachment point for the upper and lower ball joints in conventional A frame suspension system. With MacPherson strut systems, the steering knuckle anchors the lower end of the strut and the lower ball joint. The spindle of a rear wheel drive vehicle is supported and attached by the steering knuckle. With a front wheel drive vehicle, the front hub and bearing assembly is attached to the steering knuckle. Disc brake systems also use the steering knuckle as a mount for the brake caliper. The components attached to the steering knuckle will usually wear out before the
steering knuckle itself. In fact, most of the damage to a steering knuckle will occur from collision damage.

The steering wheel is connected to the suspension and wheels via the steering knuckles. The knuckle connects the steering wheel to the rest of the car, allowing the driver to direct the vehicle. Two control arms link the chassis and the front suspension, while trailing arms connect the chassis to the rear suspension.

Fig. 2: Rack-and-pinion System Conventional System
(Steering knuckle position in system)

VI. REFERENCES
[4] Dong-Chan Leea, b, Chang-SooHan “CAE (computer aided engineering) driven durability model verification for the automotive structure development”