

Weight optimization of heavy duty truck wheel

Problem description Wheel is one of the most important components of an automobile. It supports and bears the entire vehicle load. It suffers not only the vertical force but also the irregular forces resulting from the car's ride, braking, cornering, road bumps, and all uneven shocks in the process of moving on road. Due to high speed rotation, its quality has a huge impact on wheel stability, handling and other characteristics.

Moreover, there is a significant necessity about reducing fuel consumption level for automobile companies. The weight of a vehicle is one of the most important factor that affecting the fuel economy.



Fig: 3D CAD model of truck wheel.

Methodology and Execution

The weight minimization of wheel has more effective than the weight minimization of elsewhere in a vehicle due to the rotational moment of inertia effect during motion. Therefore, the wheel design should be optimized by considering fundamental attributes of a Heavy commercial vehicle such as NVH, Durability and Weight.

FE (Numerical) based Stress analysis of wheel assembly are performed to predict the stress, stress concentration regions and regions of very low stress. Where there was very low stress, the excess material was removed to reduce the weight of the gearbox. The new design is again validated for stress, vibration and fatigue loads.

A detailed durability and fatigue analysis (radial fatigue test and corner fatigue test) performed by to predict the fatigue life. A total of 14 % of the weight is reduced. These wheels are manufactured, tested and are on the road.

Conclusion

Optimisation analysis helped to reduce the weight of the wheel assembly. Also the cost of the wheel is reduced.

The weight optimization increased the efficiency of the vehicle.

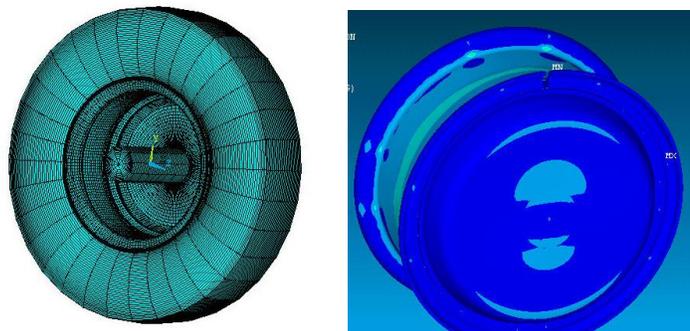


Fig: Mesh and Stress distribution on the wheel assembly