

Topology and Shape Optimization of Macpherson Control Arm under Fatigue Loading

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Abstract : In this research, the topology and shape optimization of a Macpherson control arm has been accomplished to achieve lighter weight. Present automotive market demands low cost and light weight component to meet the need of fuel efficient and cost effective vehicle. This in turn gives the rise to more effective use of materials for automotive parts which can reduce the mass of vehicle. Since automotive components are under dynamic loads which cause fatigue damage, considering fatigue criteria seems to be essential in designing automotive components. At first, in order to create severe loading condition for control arm, some rough roads are generated through power spectral density. Then, the most critical loading conditions are obtained through multibody dynamics analysis of a full vehicle model. Then, the topology optimization is performed based on fatigue life criterion using HyperMesh software, which resulted to 50 percent mass reduction. In the next step a CAD model is created using CATIA software and shape optimization is performed to achieve accurate dimensions with less mass.

Keywords : topology optimization, shape optimization, fatigue life, MacPherson control arm

Conference Title : ICADAD 2017 : International Conference on Automobile Design and Automotive Design

Conference Location : Amsterdam, Netherlands

Conference Dates : May 14-15, 2017