Abstract

Title of Document: MATERIAL FORCE APPROACH FOR TIRE DURABILITY ANALYSIS

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Tires are the most widely used composite structure of commercial importance. It is the first element of an automobile suspension system which has to carry the overall weight of the vehicle, as well as face and absorb all the road irregularities. Tire durability measures are important from safety and economical point of view for any tire industries. Tires often have cracks present inside them, but crack at critical location may play an important role in service life. The thesis offers a state of the art on the framework of material force approach for tire durability analysis using finite element method. “Material force or configurational force” analogous to physical force sums up all the forces acting on an inhomogeneity or discontinuity in material continua. Therefore, material force concept can be used to characterize the fracture mechanics in material manifold. Being a vector quantity, material force is able to provide the energy release rate as well as the crack propagation direction. This approach can be applicable in context of elastic and inelastic for small as well as large strain applications. The so-called material force approach show a unique and efficient modeling of fracture characterization and durability analysis of a radial truck tire. In this thesis a novel algorithm for evaluation of material force has been set up and the results were used for qualitative analysis of 10.00R20 TBR tires. The analysis shows a great potential in tire industries and can be further developed and could be well established as one of the tire durability parameter based on design considerations.

Keyword

Truck radial tire, durability, material force, finite element method, ANSYS