

Design, Analysis and Optimization of Space Frame for BAJA SAE Chassis

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Abstract : The present study focuses on the determination of torsional stiffness of a space frame chassis and comparison of elements used in the Finite Element Analysis of frame. The study also discusses various concepts and design aspects of a space frame chassis with the emphasis on their applicability in BAJA SAE vehicles. Torsional stiffness is a very important factor that determines the chassis strength, vehicle control, and handling. Therefore, it is very important to determine the torsional stiffness of the vehicle before designing an optimum chassis so that it should not fail during extreme conditions. This study determines the torsional stiffness of frame with respect to suspension shocks, roll-stiffness and anti-roll bar rates. A spring model is developed to study the effects of suspension parameters. The engine greatly contributes to torsional stiffness, and therefore, its effects on torsional stiffness need to be considered. Deflections in the tire have not been considered in the present study. The proper element shape should be selected to analyze the effects of various loadings on chassis while implementing finite element methods. The study compares the accuracy of results and computational time for different element types. Shape functions of these elements are also discussed. Modelling methodology is discussed for the multibody analysis of chassis integrated with suspension arms and engine. Proper boundary conditions are presented so as to replicate the real life conditions.

Keywords : space frame chassis, torsional stiffness, multi-body analysis of chassis, element selection

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