MULTIBODY/FINITE ELEMENT ANALYSIS AND OPTIMIZATION OF AUTOMOBILE STRUCTURE FOR SIDE IMPACT PRETECTION

By

KAI ZHANG

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ABSTRACT

In 1990, National Highway Traffic Safety Administration (NHTSA) upgraded the side impact protection requirements in the Federal Motor Vehicle Safety Standard (FMVSS) No. 214, and added dynamic requirements to reduce the likelihood of thoracic injuries in side crashes. In order to predict the crash worthiness of the vehicle, computer simulations have become quite popular in early stages of vehicle design. In this research, a mixed method that combines multibody with finite element approaches is carried out to simulate the side impact response in motor vehicle accidents and to analyze factors that affect the side impact protection of occupants and the vehicle structural crashworthiness.

A baseline vehicle, seat, anthropomorphic test dummy and banier are modeled with multibody approach in MADYMO cash simulation code. Critical parts of the automobile structure such as door, door beam and side airbag are constructed with finite element models. This mixed method provides details and relative data for vehicle crash worthiness analysis. Factors that influence crash worthiness such as the stiffuess of the door, B-pillar, and other side structure, door beam and side airbag are combinatively investigated, respectively. This study shows that changing the stiffuess of the door, B-pillar, side structure including A-pillar, sill and roof and adding a door beam and side airbag would decrease the struck vehicle velocity, limit the door intrusion, improve the energy absorption capacity, and reduce the injuries to the occupants. In addition, these factors are interrelated and are varied to anive at an optimized design for the best energy absorbing capacity for the vehicle structure and crashing protection of the occupants.