

# Dynamic Response Analysis of Vehicle Impact

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## ABSTRACT

The passive safety of automobiles under vehicle crash should be seriously considered during the initial design stage. According to the traffic accident statistics from National Police Administration Ministry of the Interior of Taiwan, passenger car accident rate reach 45% of all vehicle accidents. Therefore, this paper adopted Finite element software LS-DYNA and proposed a simulation procedure considering the United States Motor Vehicle Safety Standard Regulation - FMVSS208, FMVSS214 and FMVSS224 to study the behavior of vehicle perimeter frame and Ford Taurus car in the full frontal, side and rear crash. First of all, the collapse of the cylinder and simple torque-box frame is adopted to verify the simulation procedure, and then perimeter frame and Ford Taurus vehicle body structure crash analysis are studied in details, including the deformation, energy absorption, and responses of velocity and acceleration. Furthermore, during the simulation, some problems such as mesh of the finite element model, material select, contact, time step control are also discussed. In the perimeter frame crash analysis, the simulation results show that the front frame rail of perimeter frame distorts severely in the frontal impact, and the collapse mechanism is formed on the front frame horn of the perimeter frame, energy absorption approximately 98%. The frame side rail of perimeter frame distorts in the side impact, and the collapse mechanism is formed on the Torque box of the perimeter frame, energy absorption approximately 20.8%. The frame rear stub of perimeter frame distorts in the rear impact, and the collapse mechanism is formed on the frame rear stub horn of the perimeter frame, energy absorption approximately 12.6%. In the Ford Taurus full vehicle body crash analysis, the simulation results show that the front collapse area of Ford Taurus vehicle distorts severely in the frontal impact, and major energy absorption of front frame rail approximately 14.66%. The safety cage area of Ford Taurus vehicle distorts severely in the side impact, and major energy absorption of frame side rail approximately 17.69%. The rear collapse area of Ford Taurus vehicle distorts severely in the rear impact, and major energy absorption of rear floor panel approximately 48.3%. Research results of the simulation of crash of vehicle perimeter frame and full vehicle body may provide a useful reference for designers. Feature studies may be extended to consider full vehicle body structure optimization, and relate to the behavior of school bus, motorcycle and sports vehicle crash analysis.

Keywords : perimeter frame ; Ford Taurus car ; deformation ; energy absorption

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