

STRUCTURAL DYNAMIC ANALYSIS OF VEHICLE FRONT SUBFRAME & CRASH DYNAMICS OF VEHICLE OCCUPANT

By

ZHAOQUN XIA

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A front subframe is a main structure component in ground vehicles, cars, trains, and etc. The front subframe consists of vehicle body links including straight beams, double curvature thin-walled "S" beams, and localized masses. The front subframe of a vehicle is designed to dissipate before reaching occupants. In this research, four nonlinear finite element models of the front subframe are presented. The software LS-DYNA3D is used to model and simulate the structural dynamic behavior of vehicle front subframe under impact. The dynamic response of the vehicle front subframe is used as input to a vehicle occupant simulation with software MADYMO for obtaining the occupant injury parameters.

Compression and swelling near the fixed barrier and buckling in front of the crosspiece are observed in the straight zone of the front subframe. The internal "comprehensive" energy in the straight zone and the internal "bending" energy in the curved zone are analyzed. Plastic strains and stresses at various structural locations are studied and compared. Some of the simulation results are compared with available experimental test data and are validated. The structure response and energy absorption capacity of different materials and cross sections are compared and a structure with a better energy absorption capacity is identified. The obtained occupant injury parameters are found to be well below the injury threshold values.