

STUDY OF VEHICLE AGGRESSIVITY IN FRONTAL CRASH AND CORRESPONDING OCCUPANT RESPONSES

By

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ABSTRACT

The increasingly stringent safety standards, which require tests to simulate complex injuries, make virtual simulation imperative. Simulated crash testing allows hundreds of potential designs to be tested to determine how the occupant would respond in range of different scenarios such as Frontal, Side, Rear impacts and Rollover.

Computer modeling and techniques are used these days to develop and evaluate test methods, mitigation concepts and to estimate safety benefits. Computer modeling has been particularly beneficial for estimating safety benefits where often very little data is available. Also modeling allows augmenting test data by simulating crashes over a wider range of conditions than would otherwise be feasible.

The increasing number of Minivans, SUV and Pickup trucks are making roads more dangerous than ever before. The incompatibility of these vehicles with the small cars on the road is challenging crashworthiness problem for the passengers in the small cars.

Vehicle Aggressively is a program initiated by National Highway Traffic Safety Administration (NHTSA) to investigate the crash compatibility of passenger cars, light trucks and vans in vehicle-to-vehicle crashes. In this thesis, analyses are performed to study the crash dynamics of the vehicle in different crash scenarios using the LS-DYNA finite element code. The corresponding occupant injury parameters are studied using the Mathematical DYNAMIC MOdeling code (MADYMO). Detailed Finite element models of C-1500 Pickup truck and Geo Metro are used for the purpose of this study as an example of a crash between a Small Car and an L TV.

A 50th percentile Hybrid III dummy is used to study the occupant responses. Occupant compartment is modeled to study the injury responses of the dummy in Chevy Pickup Truck and Geo Metro. Both the models are validated with the full-scale sled tests. The validated models are then used to study the Vehicle Aggressivity.

The study is performed to support the NHTSA Vehicle Aggressivity Research Program. The results from this research indicated that geometric incompatibility, mass incompatibility and stiffness are the major controlling factors for Aggressivity.