APPLICATION OF A FINITE ELEMENT HUMAN AND DUMMY MODEL IN A SIDE CAR CRASH SCENARIO

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INTRODUCTION

In order to optimize side impact protection in vehicle design valid information about occupant behavior is required.
As numerical simulation provides valuable insight into crash dynamics and occupant kinematics, safety features are designed on the basis of numerical side impact dummy models such as EUROSID and USSID.
Because dummies are poor human surrogates, the performance of the safety design for human occupants is of particular interest. For this reason the main objective of the investigation was to compare a dummy and human model in a standard side impact scenario to evaluate the benefits of future safety design for human occupants.

METHODS

Applying the finite element solver PamCrash a validated FE model of a passenger car was used to simulate vehicle motion and intrusion in a standard side crash test scenario.
A compartment model in substructure-technique was developed to save calculation time during parametric analysis.

- In a first step an EUROSID finite element dummy model was used for calculating loads, accelerations and injury parameters.
- In a second step the dummy model was replaced by a 50th percentile finite element human body model developed by ESI. This model contains a deformable skeleton with thoracic and abdominal organs. The hard and soft tissues are modeled by various kinds of finite elements and material properties in order to represent adequate mechanical behavior. (fig. 1 &2).

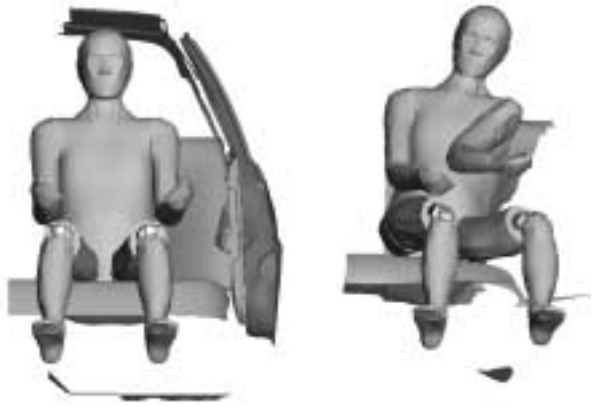

Figure 1: ESI H-Model in initial position (left) and during crash (right)

Figure 2. ESI H-Model (skin & flesh material not visible)

Simulations of the occupant movements were performed with the dummy model and the human model. Both model kinematics were analysed and finally compared.

RESULTS AND DISCUSSION

The kinematics of the two occupant models will be presented and injury parameters will be compared. The results show differences between the two different occupant models.
Future investigations will focus on the validation of the human body model considering injuries sustained in well documented real world accidents

SUMMARY

Numerical simulation with human body models provides valuable insight into crash dynamics and occupant motion. With a detailed finite element human body model additional information about possible injuries is available.
Occupant movements with dummy and human models in a side car crash scenario were simulated.
The kinematics of the human model and the dummy model in side car crash simulations were analysed and compared.
Various questions with respect to the application, validation and performance of occupant models in vehicle side impacts will be discussed.

REFERENCES

Webpage ESI (www.esi-group.com)