A PEDESTRIAN MODEL FOR ACCIDENT SIMULATION FROM THE CRASH UNTIL FULL STOP

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INTRODUCTION

The analysis of accident scenarios involving pedestrians, bicycle riders, PTW (powered two-wheeler) riders or other over-exposed persons to multi-crash accident scenarios are complex to analyze and replicate in laboratory using dummies or computer simulations.

Several approaches can be used to perform the computer simulations, namely the MBS (Multi-Body Simulation), FEA (Finite Element Analysis), or hybrid approaches. Usually, the use of MBS is suitable for long time simulations with a low CPU cost, but without the possibility to closely evaluate the injuries from the impact areas due to the simplifications typical for the MB model. The use of FEA is more accurate for assessing the injuries, since it involves more detailed description of the body, but CPU costly for long simulations.

METHODS

In this study, a hybrid approach is presented. An MB model of a 50th percentile male [1-3] is implemented in Virtual.Lab Motion, see Fig. 1. The joints, members, skin, contact parameters [4] and sensors are described in the MB model capable of handling long time simulation scenarios. For the short time periods, when the MB model is in contact with some type of obstacle (vehicle, road, urban furniture, etc.), the critical members of the body are evaluated using the HUMOS2 [5, 6] (see Fig. 2) model in Radioss in order to assess the injuries sustained in the crash.

A validation example is presented involving a stopped pedestrian and a braking van. A crash test was performed, first using the MB model (first impact validation) and then separately the following impacts using the state-of-art FE model, HUMOS2.

RESULTS AND DISCUSSION

From the MB model, the injury indexes have been computed, as the HIC (head injury Criteria) and the ThAC (thorax acceleration criteria).

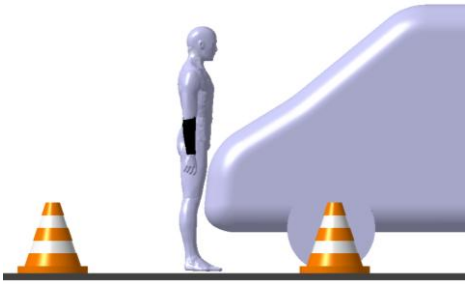

Figure 1: MBM of the human body and vehicle.

The initial conditions for the FEM analysis have been extracted for the head and the trunk in the impact with the vehicle and with the floor, for the HUMOS2 analysis.

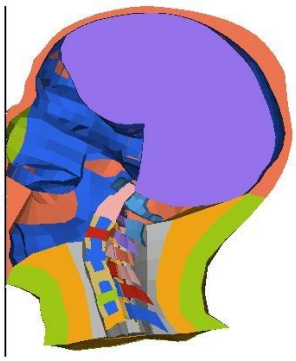

Figure 2: Section view of the head and neck during impact

CONCLUSIONS

One hybrid approach is presented to study crash scenarios in which more than one impact occurs.

Fast computing times associated with relative detail analysis is achieved by the use of the hybrid approach.

The use of a pedestrian is a first stage of this approach in the project. The next steps are to validate this approach in more complex scenarios, with motorcyclists and/or multi-impact with one or more vehicles and compare with real accidents.

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