

Occupant Safety CAE – Influence of active musculature on injury risk prediction.

The automotive industry is heading towards Autonomous Drive (AD) vehicles, while Advanced Driver Assistance Systems (ADAS) are already in the market. While the number of avoided accidents is increasing steadily, the possibilities of having accidents that are preceded by avoidance manoeuvres are also increasing. Avoidance manoeuvres could induce occupant movement which could influence occupant injury risk. Detailed Human Body Models (HBMs) are being constantly developed and are used to predict injury risks. The use of active musculature has been a key development for predicting the occupant kinematic response during low-acceleration manoeuvres.

The aim of this project is to investigate how the occupant position, muscle forces, initial velocity or stresses at the time of impact influences the occupant's injury risk.

Task description

- Review the available literature on muscle effects in occupant injury risk as well as validation performed to active human body models (A-HBM).
- Simulate the full sequence (pre-crash & crash phase) with and without muscle activation and compare occupant excursions and injury risk predictions using already existing injury criteria.
- Investigate a set of pre-crash manoeuvres (braking, steering, braking and steering) combined with frontal, oblique and side impacts.
- Study different aspects of occupant pre-crash movement and identify what affects the injury risk more. Is the occupant pre-impact posture and velocity enough to capture the full sequence response?

The project is suitable for two students with good knowledge of solid mechanics, the FE method, and biomechanics. The work will be carried out at Volvo Cars Safety Centre and Chalmers during spring 2021. FE simulations will be done using the LS-DYNA FE software.

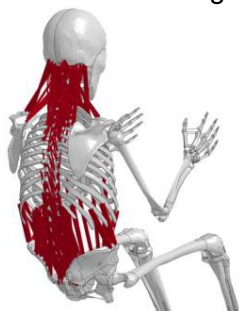


Figure: SAFER A-HBM [source: Jonas Östh - Active Muscle Responses in a Finite Element Human Body Model].

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