



# Tailored Occupant Safety: Sensor Data Driven Optimisation of Adaptive Restraint Systems

## Background

State-of-the-art occupant restraint systems, such as airbags and seat belts (equipped with pretensioners and load limiters), primarily respond to crash loads. While a limited number also consider occupant seat position for activation, the wealth of sensor data available in modern cars opens the door to more personalized restraint activation. Although this concept has been explored in simulations and laboratory tests using crash test dummies of various sizes, a comprehensive analysis is still missing. In particular, the utilization of a diverse range of detailed human body models (HBMs) exposed to a variety of crash loads presents an intriguing avenue for research.



*Exemplary occupant simulation using a human body model.*

This thesis proposal offers an exciting chance to contribute to this dynamic area of research, offering insights into the intersection of engineering, trauma biomechanics and data science. The project is supported by a major automotive OEM.

## Goals

- Effectiveness evaluation of the tailored occupant protection system in a variety of crash loads.
- Comparison to baseline (i.e. current approach) in standard crash tests.

## Tasks

- **Familiarization** with HBM-based occupant safety assessment and finite-element simulation.
- **Conceptualization** of an appropriate simulation matrix.
- **Creation of simulation setup** based on existing modules provided by the OEM and VSI.
- **Simulation and analysis** of all variants of the simulation matrix.
- **Evaluation** of effectiveness based on the results.

## Suitable for students of

- MSc Mechanical Engineering/Mechanical Engineering and Business Economics

## Organisational overview

- Start: anytime
- Performance bonus: € 2.500,- (up to 4000,- for excellent work)
- Contact: Felix Ressi, [felix.ressi@tugraz.at](mailto:felix.ressi@tugraz.at)