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EMMA4DRIVE – DYNAMIC HUMAN MODEL FOR MORE SAFETY AND COMFORT IN AUTONOMOUS VEHICLES

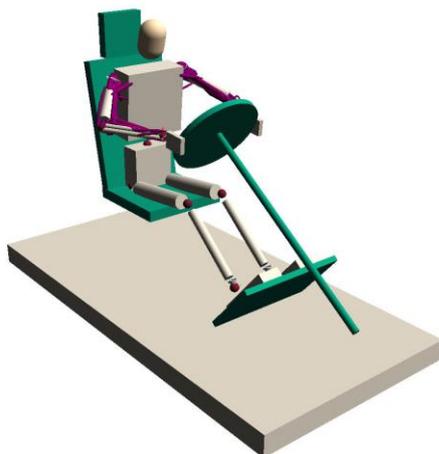


- DFG and Fraunhofer support trilateral project on autonomous driving

Fraunhofer Institute for Industrial Mathematics ITWM



For many employees, it is an inviting vision of the future: to drive to work in their own car and still make good use of the travel time: Reading news, checking e-mails or relaxing and enjoying the first coffee of the day. In the future, passengers of autonomous vehicles will be able to pursue new activities. However, this will require new (software) tools to understand customers' expectations, strengthen trust and demonstrate safety. With the EMMA4Drive project, the German Research Foundation (DFG) and the Fraunhofer-Gesellschaft are funding the development of a dynamic human model for the development of (partially) autonomously driving vehicles.



Researchers from the Fraunhofer Institute for Industrial Mathematics ITWM and the company fleXstructures are developing a muscle-activated human model together with scientists from the Institute for Engineering and Computational Mechanics (ITM) at the University of Stuttgart.

This model dynamically simulates the interaction of human body parts and the vehicle seat during driving maneuvers. The resulting software prototype, EMMA4Drive, will be used as a digital image of the passenger and will analyze and evaluate his safety and ergonomics during driving maneuvers.

The dynamic model simulates muscle control during targeted movements. This allows the comfort and injury risks of the occupants to be investigated.

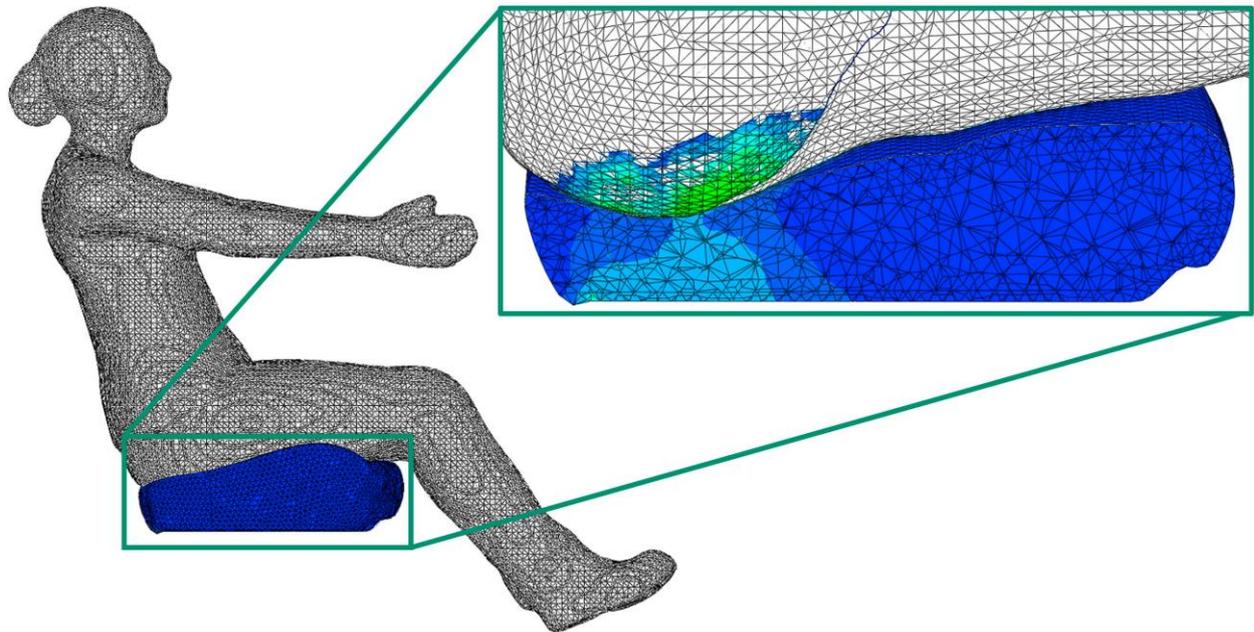
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Realistic movements instead of quasi-static investigations

So far, human models have been used either in crash simulations to estimate the risk of injury or in ergonomic analyses. In crash analyses, detailed, computationally intensive models are used for calculations in the millisecond range, which are not suitable for the simulation of dynamic driving maneuvers, because here longer processes have to be simulated. In contrast, human models for ergonomics analysis are based on the simplified kinematics of a multi-body model and so far, only allow quasi-static investigations. Realistic postures and movements during new activities can only be modeled with a lot of effort using these models.

"The by us developed prototypical human model EMMA uses an optimization algorithm to automatically calculate new postures and movement sequences with the associated muscle activities," explains Dr. Joachim Linn, head of the department "Mathematics for the Digital Factory" at the Fraunhofer ITWM, the special feature of EMMA. "This means that the new motion sequences for (partially) autonomous driving can be implemented and examined comparatively easily in the simu-

lation model - for example when the driver takes over the steering wheel."



A digital image of a female driver is used to model quasi-static sitting in the vehicle seat.
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EMMA4Drive thus enables a comparatively simple implementation of new movement patterns and an efficient virtual examination of safety, comfort and ergonomics in (partially) autonomous driving. "Our goal is to have a further developed prototype of our digital human model EMMA available at the end of the project, which we can use to investigate and improve seating and operating concepts when driving semi-autonomous or fully autonomous vehicles," Joachim Linn explains.

DFG and Fraunhofer support six trilateral projects with EUR 5 million

In the trilateral project EMMA4Drive, the University of Stuttgart contributes extensive experience in the fields of active human modeling, vehicle safety and model reduction. The Fraunhofer ITWM contributes expertise in multibody-based human modeling and motion optimization by means of optimal control. The company fleXstructures develops, distributes and maintains the software family IPS including the digital human model IPS IMMA, which simulates motion sequences during assembly work.

"EMMA4Drive - Dynamic human model for autonomous driving" is one of six projects funded by the DFG and Fraunhofer. The aim of the EUR five million funding is to involve companies in research innovations at an early stage. Three project partners each from universities, Fraunhofer Institutes and industry are cooperating on the basis of a joint working program. The Fraunhofer experts take the lead in the exploitation of the project results for the application partners or other interested parties from industry.

Source: Fraunhofer Institute for Industrial Mathematics ITWM