MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG
Institut für Mathematik

in Kooperation mit dem Marie Skłodowska-Curie ITN „Numerical Modelling of Highly Flexible Structures for Industrial Applications [THREAD]"

Im Rahmen eines Kolloquiums des Institutes für Mathematik halten

- Herr Dr.-Ing. Joachim Linn (Fraunhofer ITWM, Kaiserslautern) und
- Herr Prof. Olivier Brüls, PhD (Université de Liège, Belgien)

am **Montag, 5. Februar 2024, 16.00 Uhr** Vorträge im **Auditorium maximum** im **LEUCOREA Tagungszentrum, Collegienstraße 62, Lutherstadt Wittenberg**.

An interdisciplinary approach to modelling and simulation of highly flexible structures in automotive industry (*Joachim Linn*)

A typical wiring harness network of a modern passenger car contains about 1.5 km of cables, each of them a composite structures itself, and most of them taped together to cable bundle segments, in altogether several hundred variants. During production, all this has to be assembled into the car body, to more than 90% by human workers rather than robots, since such cable systems are topologically complex slender flexible structures whose spatial deformation behavior is still too complicated to be handled by robots.

Since more than two decades, all car manufacturers try to virtualize their product development as well as manufacturing and production processes. To support this with suitable simulation tools requires mastering of a wider range of areas in an interdisciplinary manner. Industrial applications like geometrical design, construction of single parts up to the whole product, assembly planning, digital validation of component or system functionality, up to virtual training of workers to handle (eventually robot assisted) manufacturing tasks, and in the same context perform an ergonomic assessment of working tasks to improve workplace design, cannot be covered by simulation solutions developed from methods within a single academic domain.

In the presentation, an outline will be given how this challenge is addressed at Fraunhofer ITWM by the development of solutions incorporating methods from areas like numerical and experimental structural mechanics, software engineering, computer graphics, ergonomics and human factors engineering, as well as, last but not least, mathematical methods and computational algorithms from state of the art industrial mathematics.

Numerical simulation of highly flexible slender structures: a scientific perspective (*Olivier Brüls*)

Slender and highly flexible structures, also denoted as rods or beams, are ubiquitous in engineering applications. We can cite for example mooring lines for offshore wind turbines, textile manufacturing processes, ropeway systems, cables for automotive applications or endoscopes for medical applications.

The numerical simulation of such structures brings important research questions which were at the core of the THREAD project: How can the internal physical behaviour of a slender structure with a complex cross-section, e.g., multi-fibre and multi-material, be captured by a rod model? How can the resulting highly nonlinear problem be discretised in space and time in a geometrically acceptable way? How can the models and solvers deal with complex mechanical systems composed of many rods and wires interacting with their environment?

In the talk, I will present an overview of recent scientific progresses on these questions, with a particular focus on THREAD activities. Afterwards, current trends in the field will be highlighted and some perspectives for future developments will be discussed.

Alle Interessierten sind herzlich eingeladen. (Kaffeerunde 15.30 Uhr, Seminarraum 10)

[THREAD] Numerical Modelling of Highly Flexible Structures for Industrial Applications
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 860124.