PRESS RELEASE

Fraunhofer ITWM Conducts Research in the Fraunhofer DFG Transfer Program

ProP4CableSim – Trilateral Project Simulates Cable Systems in Vehicles

No more cable clutter: The Fraunhofer Institute for Industrial Mathematics ITWM is working on the prediction of the elastic properties of cable systems in the »ProP4CableSim« project. It is part of a special transfer program of the Fraunhofer-Gesellschaft and the German Research Foundation (DFG). Partners of Fraunhofer ITWM are Saarland University and the ITWM spin-off fleXstructures GmbH.

Cable systems in a vehicle can reach a total length of up to two kilometers. As many as 900 different types of cable are installed, each with different functions and structures. Due to the increasing digitization in modern passenger cars, the number of cables required continues to rise. The problem: measuring the mechanical properties of a cable system is expensive and time-consuming. At the same time, prototypes of the cable systems are usually not available for measurements during the development phase.

Simulate and Predict Cable Properties

An efficient method to determine the mechanical properties of a cable system is experimental measurement combined with data-based prediction of the system properties. This is where ProP4CableSim (Property Predictor for Cable Simulations) comes in. The project aims to predict the elastic properties of cable systems for installation simulation. This will enable users to estimate the mechanical properties of cable systems in the early design phases and thus plan the installation space layout.

Update for »IPS Cable Simulation«

ProP4CableSim complements »IPS Cable Simulation«, the software package for the structural-mechanical simulation of cables, cable systems, and hoses; it was developed at Fraunhofer ITWM and its Swedish sister institute Fraunhofer-Chalmers Centre for Industrial Mathematics FCC in Gothenburg.

Well-known original equipment manufacturers in the automotive industry are already using IPS Cable Simulation and can look forward to many new application scenarios thanks to ProP4CableSim: The coupling effects of bending and torsion as well as

nonlinear behavior of cables are also simulated at the end of the project.

Data and Models From Science

In ProP4CableSim, research, application-oriented science, and industrial practice flow together, which is why the project benefits from the different focal points and competences of the participants: The Chair of Engineering Mechanics LTM of Saarland University performs the experimental investigation of cable samples and determines the mechanical parameters of cable systems.

The employees of the ITWM division »Mathematics for Vehicle Development« are familiar with mathematical methods for the digital factory. »We use the data from the LTM for our material modeling,« explains engineer Dr.-Ing. Vanessa Dörlich. »We focus on bending-torsion coupling as well as nonlinear behavior. The elastic behavior of smaller deformations of cables can already be effectively described if only one type of load is present, for example tension. It becomes more complicated for larger spatial deformations, because here additional coupling effects often have to be taken into account. We then link the modeled material laws prototypically to IPS Cable Simulation«.

As in previous projects, the scientists use machine learning algorithms. Results from the Fraunhofer project »UrWerk«, which deals with material data spaces for product development, complement the work on ProP4CableSim.

Material Samples From Application

The application partner is the Fraunhofer spin-off fleXstructures GmbH, which works closely with the automotive industry. The material samples are provided by them, first-hand, so to speak. »With the material samples, we ensure that the cable systems used by the industry are also taken into account in the measurement series. The sample material covers the variety of real bundle structures, so it represents all possible variants of cables and hoses,« explains Dr.-Ing. Michael Koch, research coordinator at fleXstructures GmbH.

From Theory to Practice Faster

The German Research Foundation and the Fraunhofer-Gesellschaft are funding trilateral projects such as ProP4CableSim to close gaps between basic research and application more quickly.

ProP4CableSim is starting now and is expected to run for three years. The funding amount is 850,000 euros; Fraunhofer ITWM will receive about half a million of this. fleXstructures GmbH is not explicitly funded in this program, but contributes half a
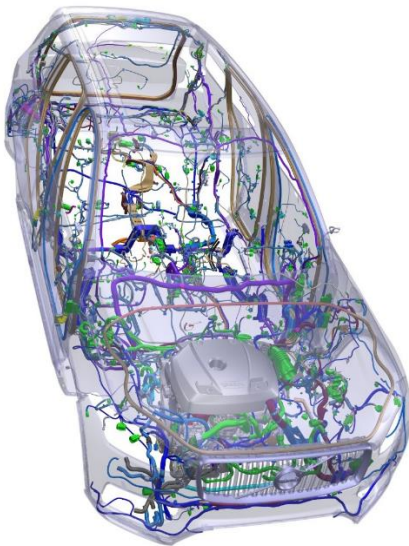
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million euros of its own. In return, the company profits from the industrial utilization of the research results after the project.
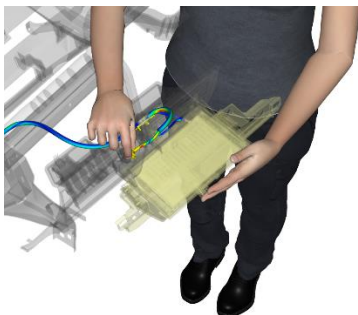
Visuals

Up to two kilometers of cables are installed in modern cars. © Volvo Cars and Fraunhofer-Chalmers Research Centre

Large deformations can occur during cable assembly; describing them better is a goal of ProP4CableSim.   © fleXstructures

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FRAUNHOFER INSTITUTE FOR INDUSTRIAL MATHEMATICS ITWM

Press contact

Ilka Blauth
Fraunhofer Institute Industrial Mathematics ITWM
Fraunhofer-Platz 1
67663 Kaiserslautern
Telephone +49 631 31600-4674
presse@itwm.fraunhofer.de
www.itwm.fraunhofer.de

About the Fraunhofer Institute for Industrial Mathematics ITWM

The Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern is one of the largest research institutes for industrial mathematics worldwide. We see our task in further developing mathematics as a key technology and providing innovative impetus. Our focus is on the implementation of mathematical methods and technology in application projects and their further development in research projects. The close cooperation with partners from industry guarantees the high practical relevance of our work.

Their integral components are consulting, implementation and support in the application of high-performance computer technology and the provision of tailor-made software solutions. Our various competencies address a wide range of customers: automotive industry, mechanical engineering, textile industry, energy and finance. This also benefits from our good networking, for example in the High performance center "Simulation- and software-based innovation".