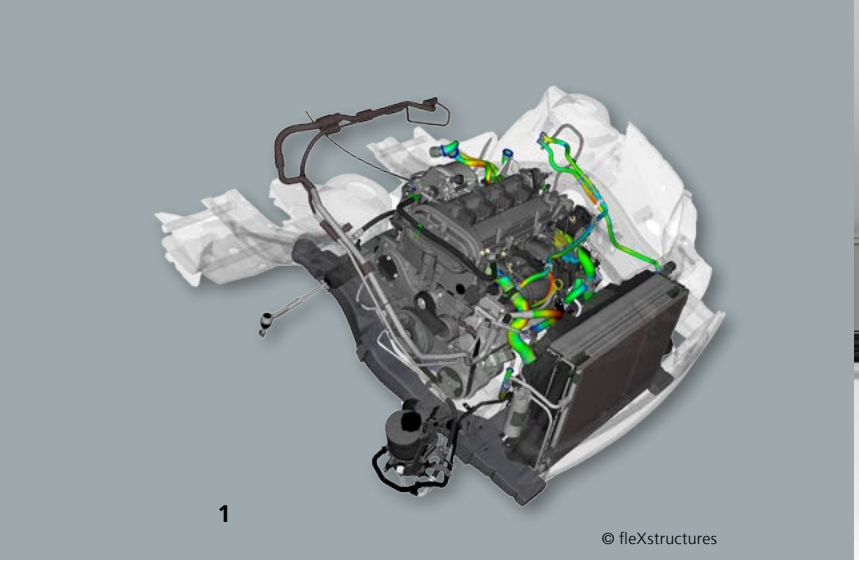

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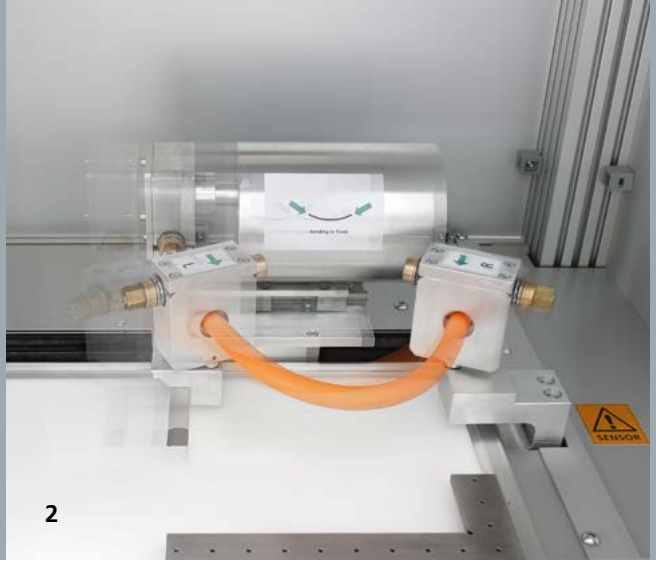

2

IPS CABLE SIMULATION AND MESOMICS® – SOFTWARE AND PARAMETERS FROM ONE PROVIDER

1 *Vehicle engine with cables and hoses*

2 *MeSOMICS bending test*

Cables are omnipresent. Looking into vehicles or other modern technical products, all contain moving cables and hoses which must not get damaged. Computer simulation helps to optimize the cable design and assembly, even before hardware prototypes are available.

However, to achieve realistic results, two essential requirements have to be fulfilled:

- The kinematical formulation and the computation of the mechanical equilibrium states, i. e. the cable deformation, must be physically correct.
- The simulation model has to include the mechanical properties of cables and hoses in a convenient way.

IPS Cable Simulation is developed by Fraunhofer ITWM and Fraunhofer Chalmers-Centre and fulfills both of the above criteria. Moreover, the computation is real-time capable and enables interactive simulation of cables and hoses.

Fast computation of cable deformations

The kinematical model is based on discrete Cosserat curves, where curvatures and strains describe the local deformation. To compute the overall cable deformation, we use the fact that static equilibrium states correspond to local minima of the potential energy of the cable.

For industrial applications with IPS Cable Simulation, a linear constitutive model with effective stiffness values integrated over the cross section is particularly useful. It turns out to be very robust and allows efficient numerical computations. Furthermore, these effective stiffness can be determined directly from measurements.

Determine mechanical properties automatically

MeSOMICS is developed especially for this purpose. The highly automated measurement system comprises an innovative bending experiment under practically relevant curvatures, a torsion experiment and a computational determination of the tension stiffness. After inserting the specimen, the measurement and the evaluation of measurement results runs automatically. In addition, an optical monitoring ensures a reliable parameter identification. Finally, a full parameter set for IPS Cable Simulation is provided. Thus, customers are enabled to measure the mechanical properties of important cables within a few hours on their own.