



Department "System Analysis, Prognosis and Control"

Analysis and Prediction of Complex System and Process Behavior

The "SYS" department develops mathematical methods for the resource-optimized real-time operation of components, drives and systems. Areas of application include the energy sector and industrial production facilities in plant and mechanical engineering. The scientific issues include the development of real-time, multivariate signal analysis methods and ML algorithms, in particular deep neural networks, as well as their hardware connection and integration for condition monitoring and predictive maintenance.

In addition, "SYS" develops model- and data-based methods for the predictive control of drives and production systems with the target variables of quality, quantity and use of resources. The scientific challenges here lie in low data availability, data and information gaps and complex process diversity.



www.itwm.fraunhofer.de/en/sys



Department "Transport Processes"

Mathematical Modelling, Simulation and Optimization of Transport Processes

The core competence of the "Transport Processes" department is the mathematical modeling of complex industrial problems and the development of efficient algorithms for their numerical solution. The problems are located in a technical and scientific context (fluid dynamics, heat and radiation transport, structural mechanics, etc.) and, from a mathematical point of view, lead to differential equations, which in many cases can be characterized as transport equations. For years, the department has continuously pursued two scientific focal points with strong unique selling points: the mathematical modelling, simulation and optimization of the dynamics of threads, fibres and filaments and the development of the grid-free continuum mechanical simulator MESHFREE. In addition, new research topics are constantly being taken up with university partners.

One example is the transient simulation, optimization and control of energy and supply networks. Fluid dynamic shape optimization is an important topic for the future and one in which we have already built up considerable expertise.



www.itwm.fraunhofer.de/en/tv