

PRESS RELEASE

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Fraunhofer ITWM at the E-world energy & water 2023

Using AI to operate plants more efficiently

Hardly any other topic is currently being discussed more: the energy transition. Researchers at the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern have also dedicated themselves to its challenges and have been developing innovative methods and models for the energy sector for years. From May 23 to 25, 2023, the researchers will present various energy projects at the leading trade fair E-world in Essen.

This is where energy supply is rethought: E-world energy & water is the meeting point of the European energy industry. Fraunhofer ITWM will again be present and will demonstrate with innovative projects how mathematical models can contribute to the energy transition and to the achievement of climate targets. Researchers from the departments "System Analysis, Prognosis, and Control" and "Financial Mathematics" can be found at a joint booth in the Innovation section.

Resource-Optimized Production

Every production plant can be optimized in many ways. This is one focus of researchers in the "Systems Analysis, Prognosis and Control" department. They are developing artificial intelligence (AI) that ensures sustainable production and intelligent energy generation and distribution.

In this way, they determine how energy demand changes depending on production steps and operating points of the plants. The aim is to be able to plan energy requirements in advance and control them optimally. However, the researchers always take into account various other production-relevant target variables: Product quality and throughput, energy utilization, use of the raw materials employed, and the condition and availability of the production facilities. The methods developed lead to sustainable, more resource-efficient plant operation.

Artificial intelligence in the control cabinet

The range of technologies includes the derivation, adaptation and implementation of algorithms, as well as the selection and integration of hardware and software in the control cabinet. Predictive maintenance, the reduction of downtimes and the maximization of plant availability through machine learning, plays a major role here. To this end, Fraunhofer ITWM created an AI that uses smart sensor data and digital twins to help avoid downtimes and keep them low, plan maintenance at optimal cost, and reduce energy and production costs while maintaining optimal quality. At E-world, the

researchers will be using a demonstrator to show how this AI can be installed in the control cabinet of machines and systems.

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Smart Production in the Beverage Industry

One example of this technology is the DESPRIMA project (demand-side and production management for beverage bottling processes). Here, smart energy management namely enables the provision of production flexibilities for grid stabilization. The researchers developed a model library whose components map the injection molding of bottle blanks and the entire beverage filling process - in terms of energy consumption, plant performance and robustness with regard to all control variables. In other words, electricity customers can flexibly influence their own consumption in order to compensate for fluctuating electricity generation from renewable energy plants at the request of the network operator and thus reduce their electricity costs.

Flexible loads on the energy market

The department "Financial Mathematics" of Fraunhofer ITWM is also on site and presents some of its projects. Their focus in energy research is on the flexibility of loads on the energy market, the development of new algorithms. For example, in the EnerQuant project funded by the Federal Ministry of Economics. Here, the researchers develop algorithms for qubit-based quantum computers and quantum simulators for the solution of an energy fundamental model with stochastic influencing variables. Likewise, the Fraunhofer ITWM presents the ENets project, which is funded by the German Federal Ministry of Education. Here, the team is creating mathematical forecast models of how electricity demand will develop over the course of the year in order to optimally design the electricity grid of the future.

The researchers of the departments "System Analysis, Prognosis and Control" and "Financial Mathematics" of Fraunhofer ITWM will present these and other projects at Messe Essen in hall 5, booth number 040 / 054, starting on May 23.

More information you can found at [2023_05_23_E-World_2023_EN - Fraunhofer ITWM](#).



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AI in hand format: Fraunhofer ITWM's intelligent micro-controller
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Press contact

Ilka Blauth
Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM
Fraunhofer-Platz 1
67663 Kaiserslautern
Telefon +49 631 31600-4674
presse@itwm.fraunhofer.de
www.itwm.fraunhofer.de

FRAUNHOFER-INSTITUT FÜR TECHNO- UND WIRTSCHAFTSMATHEMATIK ITWM**Anika Sedlmeier**

Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM
Fraunhofer-Platz 1
67663 Kaiserslautern, Germany

Telefon +49 631 31600 4220
presse@itwm.fraunhofer.de
<http://www.itwm.fraunhofer.de>

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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 applied mathematics worldwide. We see our task in further developing mathematics as a key technology and in providing innovative impulses. Our focus is on the implementation of mathematical methods and technology in application projects and their further development in research projects. The close interaction with partners from industry guarantees the high practical relevance of our work.

Its integral components are consulting, implementation and support in the application of high-performance computing technology and the provision of customized software solutions. Our various competencies address a wide range of customers: automotive industry, mechanical engineering, chemical industry, energy and finance. This also benefits from our good networking, for example in the Simulation and Software-based Innovation Performance Center.

About the Fraunhofer Society

The Fraunhofer-Society, based in Germany, is the world's leading organization for application-oriented research. With its focus on key technologies of relevance to the future and on the exploitation of the results in business and industry, it plays a central role in the innovation process. As a guide and stimulus for innovative developments and scientific excellence, it helps shape our society and our future. Founded in 1949, the organization currently operates 76 institutes and research facilities in Germany. More than 30,000 employees, most of them trained in the natural sciences or engineering, produce the annual research volume of 2.9 billion euros. Of this, 2.5 billion euros is spent on contract research.

