SIEMENS

Education

Johannes Kepler University

University uses Siemens PLM Software solutions to design F1 car component in one-third the time with half the materials

Products

NX, Fibersim, Teamcenter

Business challenges

Develop demand-oriented new plastic materials

Meet product development deadlines

Fulfill extensive documentation requirements

Adapt to changing teams

Keys to success

NX CAD for design of test items and products

NX CAE for material and product simulations

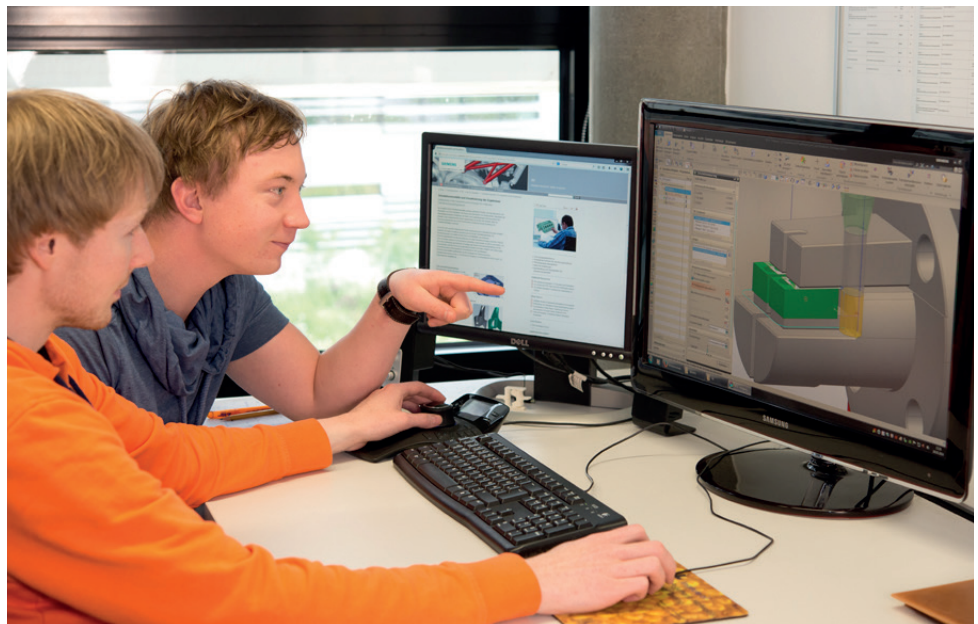NX CAM for NC programming

Fibersim for composite product development

Teamcenter for data and process management in research and development

Results

Designed a part for F1 car in one-third the time and reduced material usage by one-half

Enhanced research, education and industry collaboration efforts

Students at the Institute of Polymeric Materials and Testing of JKU design and verify test items made of new polymeric materials entirely in the virtual world before transferring these designs to reality for manufacturing and testing.

University notably enhances research, education and industry collaboration with NX, Fibersim and Teamcenter

Partner of the plastics industry
Austria is among the world's leading regions on a per capita basis for plastics processing and machinery. Seventy-five percent of Austria's plastics industry is located within a 150-kilomter (km) radius of the city of Linz, making it an ideal location to study plastics engineering and technology at Johannes Kepler University Linz (JKU). Since 2009, four plastics technology institutes that cover the entire value chain of synthetic products have become part of the university. These four cover everything from polymer material development and testing to plastic product development and continuous manufacturing technologies, such as extrusion or discontinuous production methods and injection molding and automation.

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"Comprehensive use of PLM software helps us support our commercial partners with transparent data exchange during the development of high-efficiency products and production processes. The use of Teamcenter facilitates both collaboration and complying with reporting obligations."

Professor Dr. Zoltán Major
Director of the Polymer
Product Engineering Institute
Johannes Kepler University
Linz

Industry-oriented product development
In close cooperation with industry, the Institute of Polymer Product Engineering (IPPE) performs design and verification of plastic components. Whether they are particularly large products with high rigidity, or especially small and soft parts, design and manufacture of the parts as well as the injection molds and complete assemblies are often taken care of by students as part of their bachelor's degree or master's degree thesis. To facilitate this process, a comprehensive design chain utilizing software tools from product lifecycle management (PLM) specialist Siemens PLM Software is at their disposal.

The initial step is to perform the 3D design of parts and assemblies using NX™ software for computer-aided design (CAD). If composites are used, this process is followed by preproduction preparation of fiber orientation using the Fibersim™ portfolio of software for composites engineering. Then the students verify that they

have achieved the correct material properties and product behavior. They use Teamcenter® software as their working environment in all phases of a project, not only for the comprehensive administration of all product data, but also to facilitate direct collaboration with people in cooperating companies.

"Comprehensive use of PLM software helps us support our commercial partners with transparent data exchange during the development of high-efficiency products and production processes," says Professor Dr. Zoltán Major, director of the institute. "The use of Teamcenter facilitates both collaboration and compliance with reporting obligations."

Companies equipped with Teamcenter PLM software draw extra benefit from its use as they gain direct access to the expertise of the education and research institution. Verification of their ideas for new products or processes at an academic level
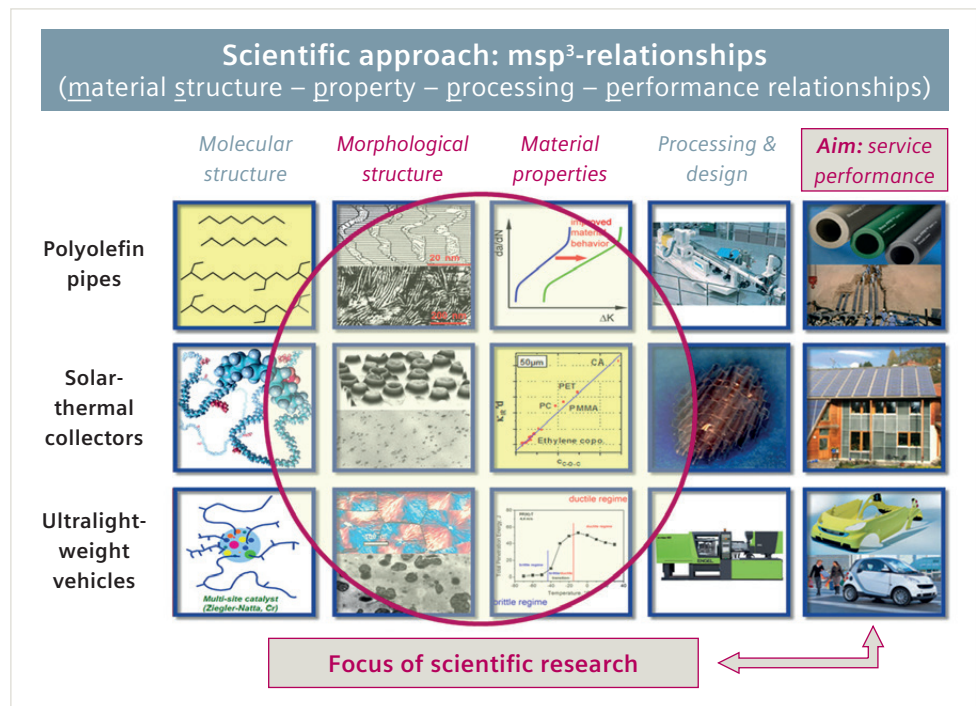
The research and development portfolio of JKU – illustrated here using three product categories that are the focus of the Institute of Polymeric Materials and Testing – includes all aspects of development and manufacturing of plastic materials and products.
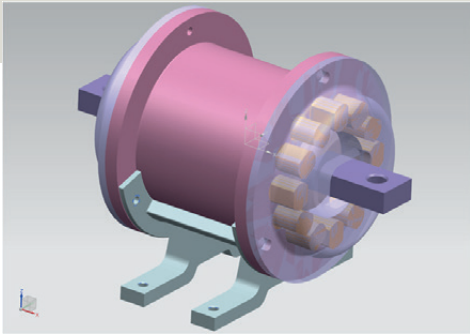
In close cooperation with industry, the Institute of Polymer Product Engineering of JKU develops new plastic products – the image shows a damper element as an example for an application of a magnetic elastomere – from design and structural simulation to physical prototypes.
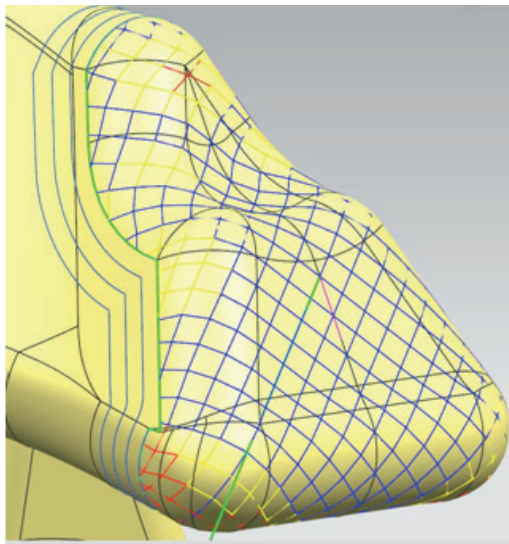
"Due to our simulation-supported approach and the use of products from Siemens PLM Software, we can considerably augment the skills of our industrial partners," Major says. "For example, we managed to design a Formula 1 race car component in one-third of the previously required time and with only half the material."

For commercial partners, the substantially reduced number of physical prototypes they require alone constitutes considerable savings.

enhances their chances in the market and helps secure the company's know-how in times of frequently changing student teams.

Simulation-based design approach
As a focal point of the university's research and development activities, simulation reaches across all associated production processes, from liquid and solid phases of the polymers (as well as their forming and other processing) to dynamic loads on the products and the resulting implications for microstructures and geometries of the components. Only after these specifications are completed in the virtual world are physical prototypes built based on the data acquired and managed with Teamcenter using a variety of methods, including additive production known as 3D printing.

Drape simulation applied to a carbon composite automotive component.

"Siemens PLM Software supports our effort in transforming new ideas in the field of advanced polymer testing to innovative solutions."

Prof. Dr. Reinhold W. Lang
Head of the Institute of Polymeric Materials and Testing
Johannes Kepler University Linz
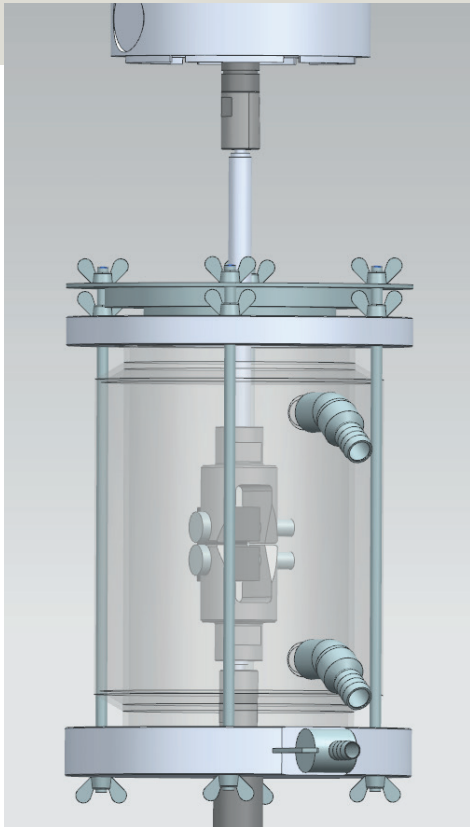
NX is used to design test equipment, as well as to verify its productive use via kinematic simulation at the Institute of Polymeric Materials and Testing.

Demand-oriented material development and characterization

At the Institute of Polymeric Materials and Testing (IPMT), new plastic materials are developed, characterized and tested. The characteristics of test items produced in-house are measured to assess the material properties. As the test items are produced using the very same methods that are planned for application in a future serial production, the value of the data determined for stress-related design and simulation is significant. "Comprehensive use of systems from Siemens PLM Software for design, simulation, machine tool programming and data management greatly facilitates these tasks," says Dr. Harald Schobermayr, senior researcher at IPMT.

At IPMT, NX is used as a CAD system for the design of test items, test equipment, tools and implements. NX also provides advanced computer-aided manufacturing (CAM) capabilities to program its computer numerical control (CNC) machine tool,

which is equipped with a SINUMERIK controller from Siemens. Additionally, NX is used in computer-aided engineering (CAE) applications for simulating mechanical load scenarios as well as thermal and rheological simulations with direct data transfer from injection molding simulations. Like the heat and fluid flow simulations during the cooling off of injection molds, these are essential for material assessment in subsequent part production processes.
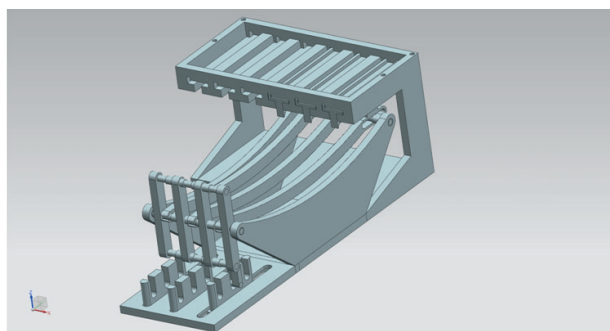
Fibersim helps the team at the university to understand the limitations of composite part manufacturing processes early in the design phase. It includes extensive capabilities to exchange data with CAE in order to optimize the part performance and provides all needed manufacturing deliverables like flat patterns and ply books.

Throughout this university, Teamcenter is employed for the comprehensive administration of all relevant information throughout the process chain, from raw material, formulation, processing, test item production and testing, to the material characteristics.

"Seamlessly using these software tools from Siemens PLM Software enables fast, demand-oriented development of new materials with transparent and repeatable results," notes Schobermayr. "Teamcenter also supports us in our efforts to build up a plastics-specific knowledge repository without inflicting onerous administrative efforts."

The reversible logic of the multiplying machine built in 1840 by Thomas Fowler is made accessible to JKU students in a replica built by an institute within the Department of Computer Science using 3D printing.

Solutions/Services

NX CAD
NX CAE
NX CAM
www.siemens.com/nx

Fibersim
www.siemens.com/plm/
fibersim

Teamcenter
www.siemens.com/teamcenter

SINUMERIK
www.siemens.com/sinumerik

Customer's primary business

Established in 1966, the Johannes Kepler University (JKU) in Linz, Austria offers 60 fields of study, providing a multidisciplinary and practical education that is in line with current demands from industry and society and enjoys a favorable international reputation for its fundamental as well as application-oriented research.
www.jku.at
www.kunststoffstudium.at

Customer location

Linz
Austria
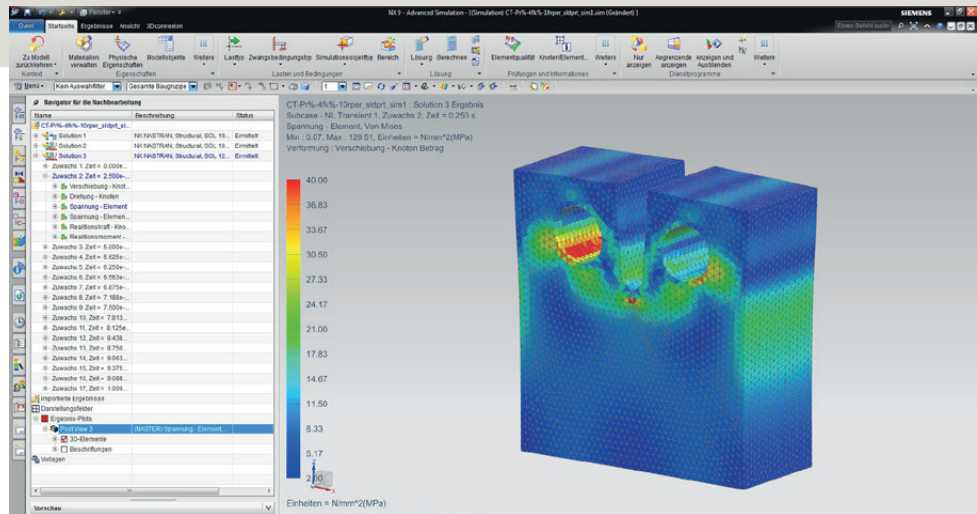
With NX CAE software, material stress simulations can be carried out using test items with new material properties or finished parts at the Institute of Polymeric Materials and Testing.

Better opportunities for all

The comprehensive use of cutting-edge software tools for CAD, CAE, CAM, fiber composite materials design/production and complete PLM across its research and development efforts, tuition-based classroom instruction and collaborative industry projects boosts the university's ability to quickly and efficiently accomplish complex plastic technology tasks. This is further aided by support from Siemens PLM Software experts. With active project support, they help the institutes to maintain a leading technology position, so they can offer discernible added value to community and industry.

This in turn elevates the industry's readiness to support the university and enhances career opportunities for students. Because the students use the same methods and tools as many of their prospective employers, many of them have signed contracts well before graduating.

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Professor Dr. Zoltán Major
Director of the Polymer Product Engineering Institute
Johannes Kepler University Linz

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