SIEMENS

ACADEMIC

Aalen University of Applied Sciences

Providing students with holistic systems design engineering skills

Products

NX, Teamcenter

Business challenges

Provide the industry with systems design engineers

Teach future engineers product data management skills

Impart the ability to cover the entire product origination process

Educate engineering students capable of taking a broader perspective

Keys to success

Provide engineering courses that span the entire product origination process

Employ results-driven learning

Use NX for all design work

Use Teamcenter for PDM teaching

Use a modular, configurable system approach

Results

Provided students with holistic systems design engineering skills

Used problem-based projects to prepare students for complex engineering software environments

Empowered future engineers to tackle complex challenges

Aalen UAS uses NX and Teamcenter in problem-based projects to prepare students for complex software environments

Educating future engineers

The city of Aalen in southern Germany is in a region that has a high density of industries and is known for its innovative spirit. These industries include pulp and paper, machine tools and leading car manufacturers. All these companies need engineers who can leverage cutting-edge methods and software tools to develop superior products with a short time-to-market, securing the future prosperity of their companies and the region.

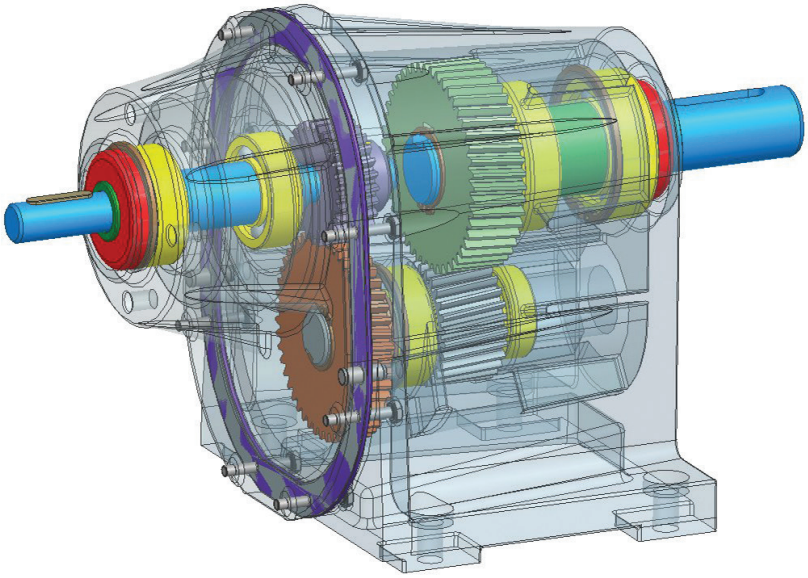
With study programs tailored to the requirements and trends of the region, Aalen University of Applied Sciences (Aalen UAS) educates the highly qualified students who are crucial to the future of these companies. Founded in 1963 as a state engineering school and transformed into a university of applied sciences in 1971, the university has been a reliable partner for the regional economy as well as more than 100 corporate partners worldwide. Aalen UAS is one of the strongest research universities of applied sciences in Germany, embracing technologies ranging from digital networking and information (IT) security, health, autonomous driving and e-mobility to artificial intelligence (AI), industrial automation and systems engineering, renewable energy, photonics and robotics.

Dr. Thomas Weidner uses NX and Teamcenter to instruct students in product design and production.

> Using Siemens software, our students tackle product design tasks well beyond modeling particular parts and assemblies."

Dr. Thomas Weidner
Professor, Digital Product Design
Aalen University of Applied Sciences

In practice-oriented study programs and in cooperation with regional companies and institutions, Aalen UAS leverages Siemens Digital Industries Software solutions, including NX™ software and Teamcenter® software, to improve the education of future engineers. As part of the university's practice-oriented education, Dr. Thomas Weidner, who is a professor of digital product design at Aalen UAS, uses NX and Teamcenter in his bachelor's degree and master's degree courses in mechanical engineering.

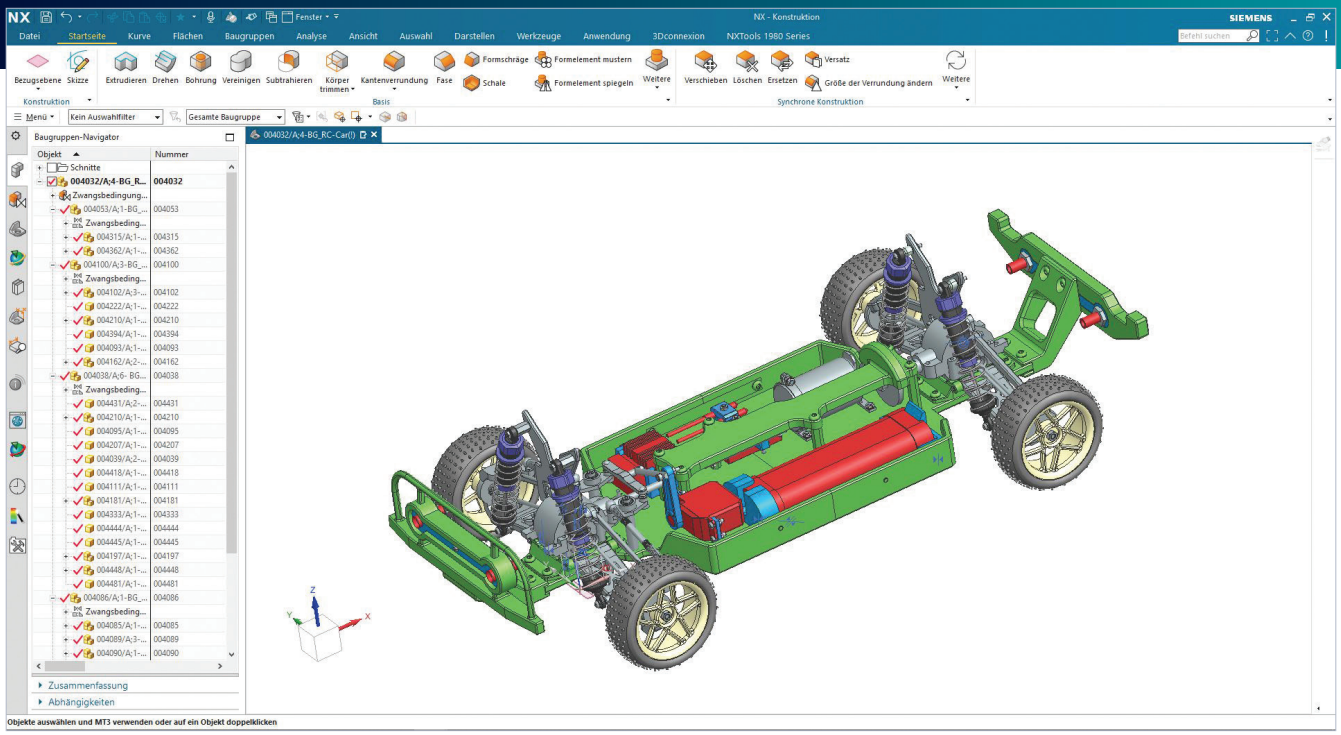


During early semesters of a bachelor's course in mechanical engineering, Aalen UAS students use NX to work on 3D models of a gearbox.

Introducing students to PLM

"Mechanical Engineering/Development: Design and Simulation" is the name of a seven-semester bachelor's course. After the first year, students are required to choose technical design, simulation or vehicle technology as their focus of study. The course links industrial design with engineering skills, enabling its graduates to be fluent in the languages of industrial and product designers. This facilitates an important link between these separate parts of the product origination process.

During the first semester, all participants learn freehand sketching so they can exchange technical and design ideas and information. Then they spend six semesters working on a project that supplements their studies. The students use NX for all computer-aided design (CAD) to work on 3D models of a gearbox and its components. These are taken out of a collection called "NX for Beginners."



In a six-semester project, Aalen UAS students formed teams to design and build a radio-controlled car spanning the entire product origination process, from freehand sketching to industrial design to CAD/PDM and often including various forms of simulation.

During the first four weeks, the students learn about the basic functionality of a product data management (PDM) system, receiving the required theoretical knowledge in lectures called the PDM laboratory. After that, they work on the entire product origination process of the gearbox, using NX for everything from designing and modifying parts and assemblies to exporting drawings and other artifacts. They also use the functions of Teamcenter for PDM. This includes importing external CAD data and nontechnical information as well as setting up and using approval workflows and revisioning.

Covering the entire product origination process

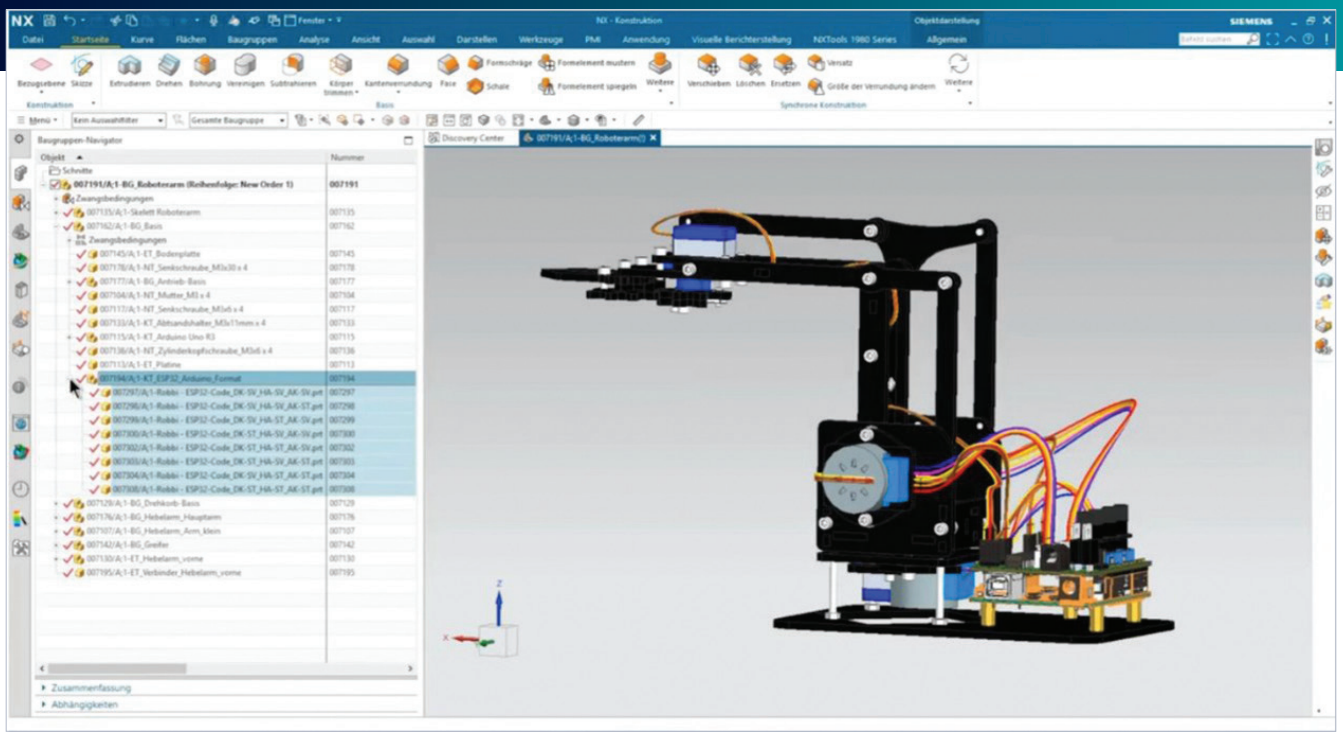
To pass the first exam, the students import a complete 3D model into Teamcenter, review and revise the faulty product structure and produce non-CAD presentation slides to document the changes. They also assign these modifications to document revisions and obtain approval using Teamcenter workflow mechanisms. This process is repeated after making another modification to ensure that non-CAD data is included in the change process.

This is followed by a practical project to design a given product such as a radio-controlled (RC) car, a drone or an industrial robot from scratch, and finally producing it using additive manufacturing (AM). The students form teams to work on their chosen specialization. Their tasks span the entire product origination process, from freehand sketching and industrial design to CAD/PDM, often including various forms of simulation.

Students who have acquired their bachelor's degree in engineering can go on to the "Data Management in Product Development and Production" master's degree program. Although the course requires CAD skills and command of software such as NX, it focuses on using Teamcenter to create configurable products with a variety of versions and options. "Using Siemens software, our students tackle product design tasks well beyond modeling particular parts and assemblies,"

"Using NX and Teamcenter, our students can go all the way from converting sketches to 3D models to design verification to preparing fully configurable mechatronic products with comprehensive BOMs within one consistent environment."

Dr. Thomas Weidner
Professor, Digital Product Design
Aalen University of Applied Sciences



As part of the Data Management in Product Development and Production master's degree course, students use Teamcenter to design a configurable robot.

"With a deep understanding of all industry requirements and the ability to use cutting-edge software like NX and Teamcenter to fulfill these needs in a holistic way, these graduates are the systems designers our industry so desperately needs."

Dr. Thomas Weidner
Professor, Digital Product Design
Aalen University of Applied Sciences

says Weidner. "From day one of their master's courses, we teach them model-based systems design that covers a wide range of requirements."

Designing a configurable robot

The main objects students work on during this course is a 4-axis robot. Following four weeks of preparatory lectures on PDM theory and exercise work, they start by using NX to build a 150 percent structure of the robot. The students design only one-third of the robot's 191 parts, while about half are standard parts like screws and one-sixth are purchased components. Among these are a selection of servo and stepper motors used to drive the axes, and a choice of two processor boards for robot control.

Following a quality review, the students dive into variant management. They use Teamcenter to capture the desired variance and features and to assign these to the product line. This results in a variant matrix with 16 options covering the choices of two control units and either a servo or stepper motor for three of the robot's four axes. Still solely using Teamcenter, the students define configuration rules. Using NX as well as Teamcenter, which are part of the Siemens Xcelerator business platform of software, hardware and services, the students go on to link features and rules with the product, which allows them to finally configure the robot.

As the students are required to design the robot as a mechatronic entity, the variety also includes 16 software code sets. These software code sets are introduced to the overall design as CAD files. This way, the correct code automatically becomes part of the individually configured robot's bill-of-materials (BOM). Linking PDM and enterprise resource management (ERP) software is becoming increasingly commonplace, which means that each configured product is shipped with the right software without requiring extra work.

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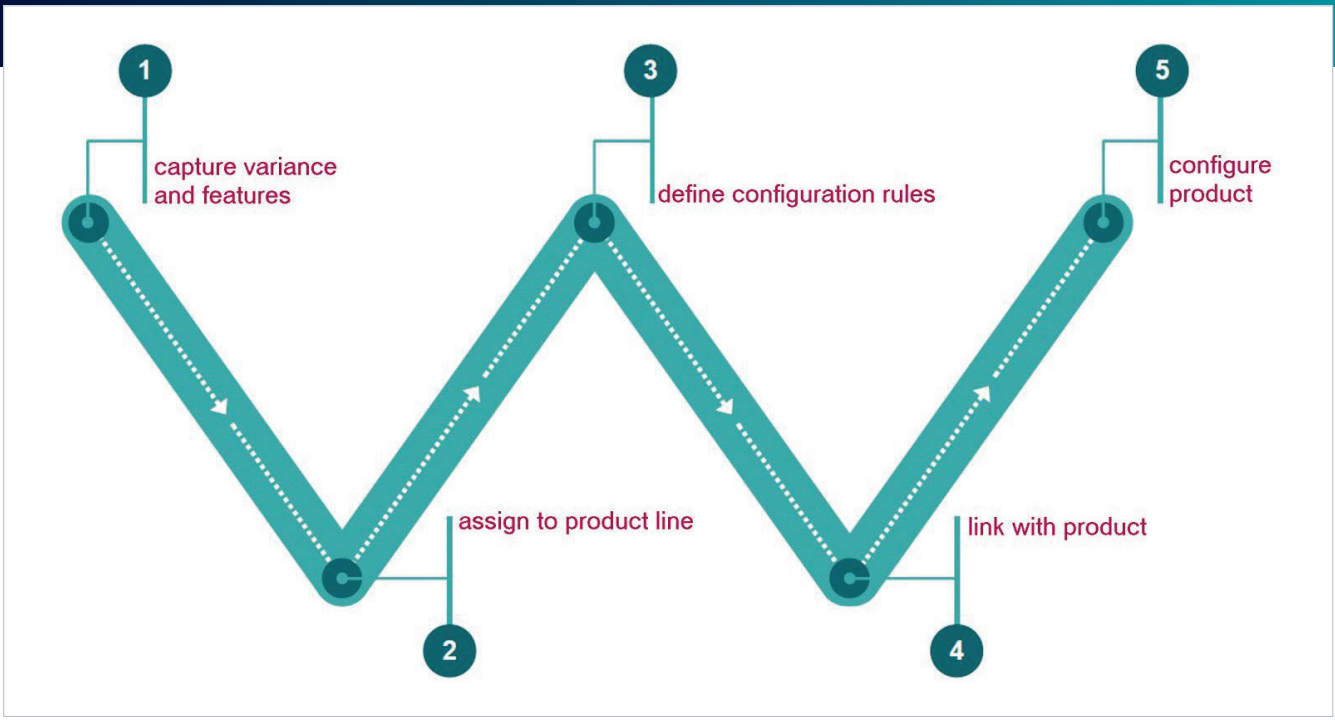

The course covers all aspects of variant management, from capturing the desired variance and features and assigning them to the product line to defining configuration rules, linking features and rules with the product to finally configuring the robot.

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mechatronic products with comprehensive BOMs within one consistent environment," Weidner points out. "This reduces software-specific teaching efforts and saves time for searching, helping us to educate more universally knowledgeable systems engineers."

Understanding digitalized industry

Weidner's ambition is not to rapidly provide the industry with narrowly focused specialists, but to develop generalists that understand the interrelated requirements of the digitalized industry. This requires an aptitude for setting up and working out interdisciplinary digital processes covering product design and production. Along with traditional mechanical engineering skills, Aalen UAS graduates are familiar with data acquisition techniques and methods used to network complex systems. They are also knowledgeable on topics such as data and cybersecurity and they know how to analyze data to leverage them for optimization.

Solutions/Services

NX
siemens.com/nx

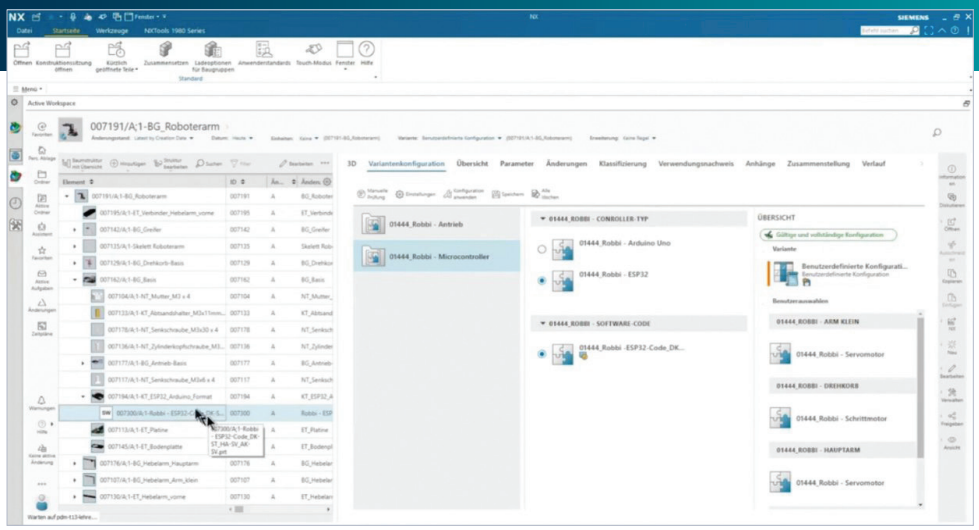
Teamcenter
siemens.com/teamcenter

Customer's primary business

Aalen University of Applied Sciences (Aalen UAS) is one of the strongest research universities in Germany and educates bachelor's and master's level candidates in fields ranging from digital networking, health and e-mobility to renewable energies, photonics and robotics. With around 4,500 students, it provides a practice-oriented education.
www.hs-aalen.de/en/

Customer location

Aalen
Germany



During the master's degree course, Aalen UAS students use Teamcenter to design a configuration tool.

"Our students learn much more than just classical mechanical engineering," Weidner concludes. "With a deep understanding of all industry requirements and the ability to use cutting-edge software like NX and Teamcenter to fulfill these needs in a holistic way, these graduates are the systems designers our industry so desperately needs."

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siemens.com/software

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