

Academic

Katholieke Universiteit Leuven

Belgian university uses Siemens solutions to educate future engineers in product design and manufacturing

Product

NX, Simcenter, Teamcenter

Business challenges

Teach product development and production

Enable students to utilize digitalization

Instruct students how to combine product design, verification and production

Keys to success

Provide university-wide access to Siemens software and online learning

Use Solid Edge and NX for all design work

Use Simcenter for design verification

Use Teamcenter for information management and collaboration

Results

Provided students with product development skills using complete digital twins

Enabled students to design products optimized for production

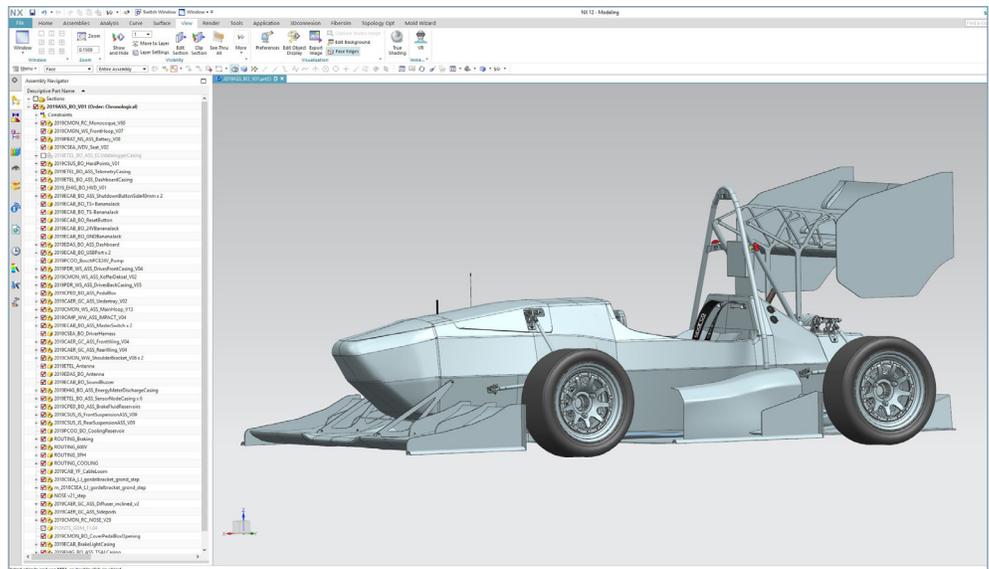
Empowered students to maximize design and production efficiency

NX, Simcenter and Teamcenter help KU Leuven prepare students for the manufacturing industry's digital transformation

A digital engineering education approach Katholieke Universiteit Leuven (KU Leuven) is the largest university in Belgium. At its main campus in Leuven and 14 satellite campuses spread across the country, more than 58,000 students are enrolled in 50 faculties and departments. Over 20 of these form the university's science, engineering and technology group. Following a restructuring of the Belgian education system in

2013, engineering schools providing a more practical education on an academic level are now part of a wider KU Leuven network.

"Within this group, we have three engineering profiles: engineering sciences, engineering technologies and bioscience engineering," says Professor Dr. Ir. Bert Lauwers, Dean, Faculty of Engineering Technology, KU Leuven. "To us, academic does not merely mean producing papers; we consider it a way of thinking. KU Leuven's approach to preparing engineering students for their professional careers and as market innovators for Industry 4.0 makes the university arguably one of the best in Europe."



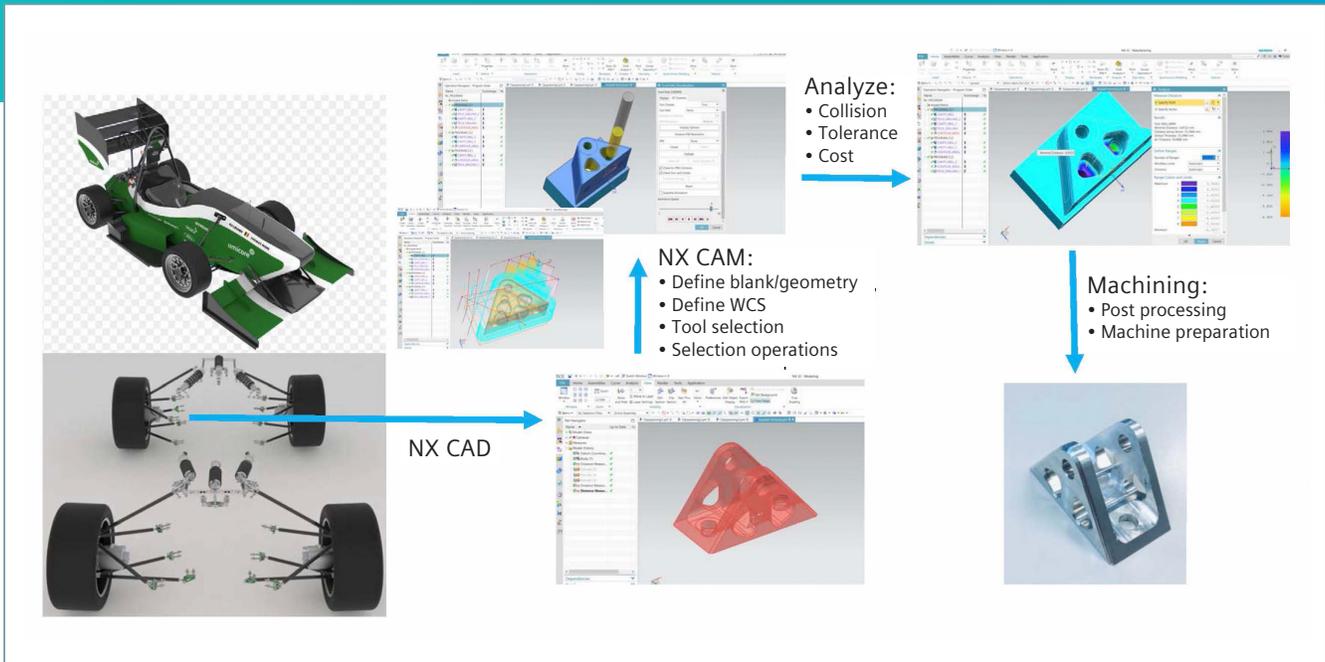


Figure 1: KU Leuven students on the eClique Formula Electric team build electric racecars used in Formula Student challenges. In an intelligent manufacturing course, they use Siemens Digital Industries Software solutions such as NX, Simcenter and Teamcenter to cover the entire product creation process chain. All images unless stated otherwise: KU Leuven

“In a curriculum as broad as ours, use of the various software products varies with the requirements of the individual projects. PhD students going into the depths of computer-aided design and manufacturing often use combinations of Siemens Digital Industries Software products.”

Professor Dr. Ir. Bert Lauwers
Dean
Faculty of Engineering Technology
KU Leuven

KU Leuven pursues an open approach so every student, no matter their major, can visit the fabrication laboratory (FabLab) on campus to experiment using the equipment there, including several 3D printers.

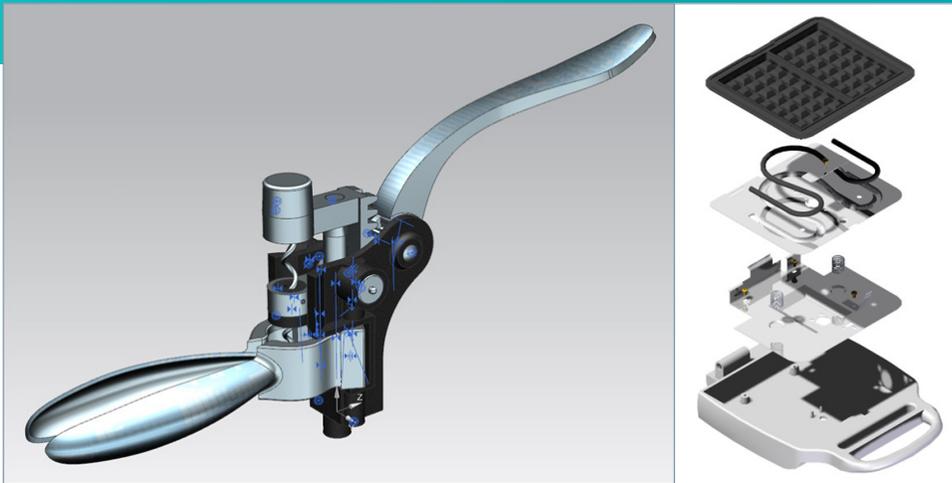
The Faculty of Engineering Science has a five-year curriculum and is fully located in Leuven. The four-year curriculum of the Faculty of Engineering Technology is more practically oriented. It is spread over several campuses across the Flemish region of Belgium. One of KU Leuven’s locations is the De Nayer campus in the Mechelen region the university shares with the associated Thomas More University College, where students finish their three-year education as professional bachelors.

Learning to build digital twins

In virtual product development courses, KU Leuven engineering students from the two faculties use Solid Edge® software, the most complete system for 2D/3D computer-aided design (CAD), from Siemens Digital Industries Software to model everyday products. As their assembly structures and shapes get more complex, third-year bachelor and master students switch to Siemens’ NX™ software, a leading integrated solution for computer-aided design, manufacturing and engineering (CAD/CAM/CAE). In these courses, students learn to apply various design methods including parametric modeling. They also learn to understand the influence the manufacturing process can have on the CAD model or the product itself.

“KU Leuven students also enjoy unlimited free access to the Learning Advantage e-Learning portal.”

Professor Dr. Ir. Bert Lauwers
Dean
Faculty of Engineering Technology
KU Leuven



“Part of what we are teaching them is that a digital twin is not complete unless it represents the entire behavior of a product.”

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Figures 2-3: In a virtual product development course, students at KU Leuven use Siemens Digital Industries Software’s Solid Edge software and NX CAD software to model everyday products with complex assembly structures and shapes.

As part of the overall task, students discover the information loss often related with the usage of open CAD file formats such as the Standard for the Exchange of Product model data (STEP) or the Initial Graphics Exchange Specification (IGES). The result of their work is a digital twin of the product they have designed.

“Our students started creating digital twins 15 years ago, long before designations such as the digital factory or Industry 4.0 were coined,” says Prof. Lauwers. “Part of what we are teaching them is that a digital twin is not complete unless it represents the entire behavior of a product.”

In a computer integrated manufacturing course, students first learn how to program a machine tool directly on its human machine interface (HMI). Starting out with a file created using Solid Edge, they create simple objects such as a metal model of a beer glass designed for a famous Belgian brewery. Later, the students use NX CAM to develop postprocessors and create programs for five-axis numeric control (NC) machine tools.

They also validate the programs by simulation using the digital twins of both their products and the machine tool, using software from the Siemens Simcenter™ portfolio. Finally, they verify the result of these simulations by actual machining.

Fully scalable software support

During a project on machining gears, mechanical engineering students integrated a laser tool with a 5-axis machine tool to facilitate pre-machining, laser hardening and finishing on the same machine. Moving the laser from position to position using the axis of the machine tool is too slow, resulting in excessive annealing. Together with their instructor and a Doctor of Philosophy (PhD) student, the students combined moving the axis with fast laser scanning. Using NX software, they developed a post processor for this integrated process, reducing the time required to produce prototype gears.



Figure 4: KU Leuven students used NX software to create programs for numeric control machine tools. They validated the programs by simulation using the digital twins of a spiral bevel pinion and the machining center, finally comparing the simulation results with the actual machining process.

In the frame of a postgraduate program to promote innovative entrepreneurship, KU Leuven students from the Faculty of Engineering Technology and students from the Thomas More University College build electric racecars for Formula Student challenges. KU Leuven's eCclipse Formula Electric team is a large group of students working together under tight deadlines. Aside from using NX CAD, NX CAM and Simcenter for various simulation tasks, they also use software from Siemens' Teamcenter® portfolio.

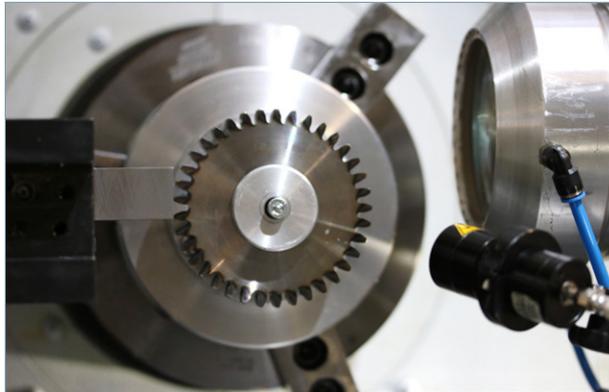


Figure 6: Using NX software, a KU Leuven student programmed a post processor for simultaneous machining and selective laser hardening in a 5-axis machine tool, reducing the time required to build a prototype gearbox complete with all cogwheels from one month to one day.

Somewhat more removed from the mainstream of product design and manufacturing, PhD students at KU Leuven are leveraging Siemens software in bone cancer research. The aim is to research the influence of the cavities caused by bone cancer on the strength of the affected bone. Using Simcenter, they perform strength analyses on the digital twins of the actual bones converted from scans into 3D models using NX. Using this software, they also create NC programs and mill the cavities found in X-ray images of real bones to verify the results in real-life strength tests. The students also apply this method to test the properties of various kinds of cement used to fill the cavities.

Fruitful long-term relationship

"In a curriculum as broad as ours, use of the various software products varies with the requirements of the individual projects," says Prof. Lauwers. "PhD students going into the depths of computer-aided design and manufacturing often use combinations of Siemens Digital Industries Software products."

Today, KU Leuven provides Siemens products to all his engineering students, as well as students studying at the different university colleges within the KU Leuven association. Students can borrow any of the nearly 7,000 Siemens manufacturing licenses for offline use in project work at home.

“Siemens provides us with the software resources we require to educate students to become engineers fit to tackle future challenges.”

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Solutions/Services

NX

[siemens.com/nx](https://www.siemens.com/nx)

Simcenter

[siemens.com/simcenter](https://www.siemens.com/simcenter)

Teamcenter

[siemens.com/teamcenter](https://www.siemens.com/teamcenter)

Customer's primary business

The multi-campus KU Leuven is one of Europe's oldest universities. Dedicated to education and research in nearly all fields, it offers education as well as research activities organized by the departments and research groups. Its faculties and departments are clustered into three groups: Humanities and Social Sciences, Science, Engineering and Technology (SET), and Biomedical Sciences. Each of these groups has a doctoral school for its doctoral training programs. www.kuleuven.be/english

Customer location

Leuven

Belgium

"KU Leuven students also enjoy unlimited free access to the easy-to-use, convenient Siemens Learning Advantage e-Learning portal," says Prof. Lauwers. "Requiring only an internet browser, it provides cost-effective and time-efficient methods for users to gain skills and knowledge of Siemens Digital Industries Software solutions." Students have access to a vast library of self-paced courses and assessments.

This liberal use of the engineering software is based on a fruitful long-term relationship between Siemens and the university dating back more than 30 years. In fact, LMS International, the makers of part of the Simcenter portfolio for simulation and test, originated as a spin-off of KU Leuven's faculty of engineering science.

Part of the cooperation is a so-called "Dual Desk" doctorate program. There, Siemens-employed researchers conduct PhD research under joint supervision of an academic promoter and an industry promoter. Furthermore, Siemens regularly hosts academic researchers for secondments or joint experiment sessions, a program widely recognized as an innovative way of cooperating between industry and academia.

"Our partnership with Siemens provides us with the software resources we require to educate students to become engineers fit to tackle future challenges," says Prof. Lauwers. "The growth of that company's software portfolio has generated many opportunities for us to teach students how to efficiently utilize digitalization for their purposes."

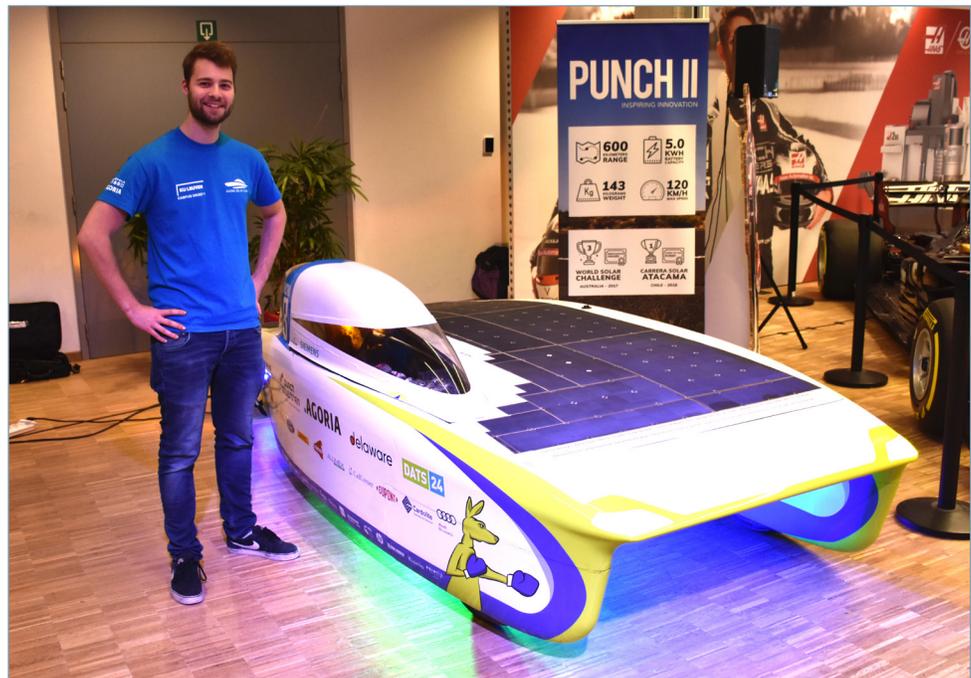


Figure 7: KU Leuven students on the Agoria Solar Team use Siemens Digital Industries Software solutions to design, simulate and build solar-powered vehicles with which they successfully participate in the annual Bridgestone World Solar Challenge.

Siemens Digital Industries Software

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