

Education

University of Bath

One of the UK's leading universities uses advanced PLM technology to provide real-world engineering design experience to its students

Products

Solid Edge, NX

Business challenge

Facilitate engineering students in gaining practical design, engineering and manufacturing knowledge, especially skill and experience that can be applied commercially

Keys to success

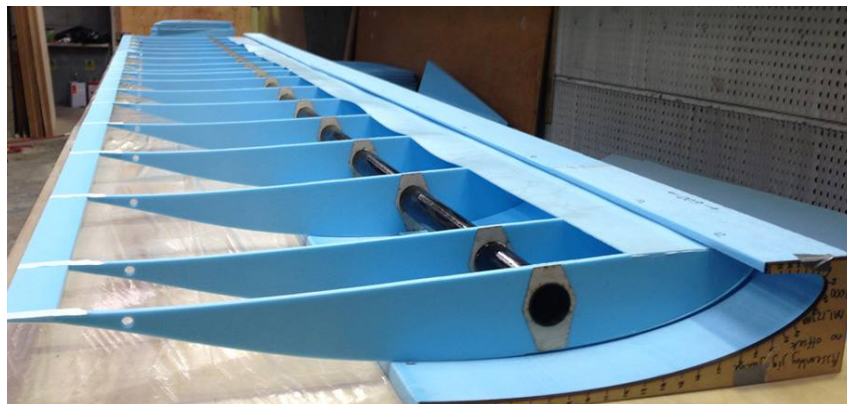
1,000 students each have their own copy of Solid Edge
Advanced students have access to the comprehensive features of NX

Solid Edge and NX are integral to practical design and build projects, with synchronous technology promoting speed and understanding

Results

Students enter commercial marketplace with skills in advanced CAD technologies for mainstream engineering

Many students graduate with notable experience in using both Solid Edge and NX



Solid Edge provides easy-to-use mainstream engineering and design solution for students and provides a strong foundation for those looking for the enterprise-level capabilities of NX

Engineers who excel

One of the top UK universities for research, teaching, the student experience and employability, the University of Bath was ranked third after Oxford and Cambridge in *The Times Good University Guide 2012*. Mechanical Engineering was one of three individual subjects for which the university was ranked number one.

Engineering students from the university follow a common curriculum for the first two years before they specialize. In that time, they learn about workshop practice, experimental methods, data analysis, pro-

totype building and common engineering elements. They are all given the opportunity to do an industrial placement, which enables them to apply course learning in real life. Their achievements are demonstrated by continuing success in Formula Student, which is one of the leading educational motorsport programs and is supported by the Institution of Mechanical Engineers. Team Bath Racing (TBR) is well established, designs a bold, new racing car each year, and attracts extensive commercial sponsorship. University of Bath engineering students are also achieving success and recognition for projects involving the design, build and operation of a human-powered aircraft and a human-powered submarine.

Of the 1,000 engineering students enrolled at any one time, each has an individual copy of Siemens PLM Software's Solid Edge® software, supplied and sup-

Results *(continued)*

Graduates leave with real-world edge in design for manufacturing

An engineering graduate was the overall winner of the popular UK television series "The Apprentice" in 2011

Team Bath Racing has a track record as the best UK team competing in the Student Formula program

Mechanical Engineering was one of three individual subjects for which the university was ranked number one in the UK

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Jeff Barrie
Academic Administrator and Design Support Engineer
University of Bath

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ported by Siemens PLM Software partner Majenta PLM. First-year students learn to use the software for their initial design-and-make project, which comes in the second semester. "This is their introduction to Solid Edge and they immediately see and experience the benefits," says Jeff Barrie, academic administrator and design support engineer. "They find the Engineering Reference tools very useful for entering engineering properties and rough ideas, and generating basic components such as gears."

"An excellent introduction to CAD"

Barrie describes the merits of using Solid Edge for teaching computer-aided design (CAD): "Solid Edge is so easy to use, it provides an excellent introduction to CAD. Students quickly understand and appreciate how the software saves the time and effort of modeling from a blank

screen or recalculating when making a component using the pathfinder. In the third year, students also use Simulation Express within Solid Edge, as it is so easy to do FEA (finite element analysis)."

CAD becomes more significant during the second year, when students begin more complex projects in which they are asked to consider transmission sub-assemblies, product design and use of an automated-assembly machine. This is an opportunity to develop a substantial design project in which students are expected to show concept development and evaluation, and think about volume manufacturing.

Through exposure to Solid Edge, students begin to appreciate why so many companies use this software. "It is quite important for students to understand that Solid Edge is the perfect solution for many orga-



nizations, particularly SMEs (small and medium sized companies), because in addition to being easy to use, it is also easy to implement," says Barrie. "Having used Solid Edge for project work in years two and three, students find that if they later want to make the transition to NX, it is an easy incremental step."

He notes, "We also license NX because it's industry-standard, enterprise-level software, and is used by some of the major employers who recruit from our pool of graduates. It is used extensively in our CAM (computer-aided manufacturing) and metrology research; our CNC (computer numerical control) machines are compatible with NX software."

Aydin Nassehi, lecturer and CIRP (The International Academy for Production Engineering) Research Affiliate, adds, "For those students making the transfer from Solid Edge to NX, we can extend our teaching of CAM by using NX manufacturing, enabling them to appreciate the advantages that an enterprise-level system offers relative to computer integrated manufacturing."

It is with an eye on the future that many students decide to learn both Solid Edge and NX™ software. Members of TBR, for example, insist on use of the Siemens PLM Software solutions environment for its comprehensive assembly, surfacing, CAM and toolpath functions and for the integrated finite element analysis (FEA) and computational fluid dynamics (CFD) capabilities available with NX Nastran® software. "Such integration saves students the time and effort of converting data into different applications," says Barrie.



TBR members have their favorite NX features. "Wave inter-part linking in NX has been essential for us; we've used it extensively to ensure that parts connect," says Daniel Balsas, MEng.

Philippa Morris, MEng, adds "I frequently use the assemblies feature to confirm an arrangement and check for clashes."

Dave Turton, 2014 Formula Student Team Leader, says, "Using the tube function allows quick parametric modeling of the rear frame structure for our 2014 car. This has given us the flexibility to quickly try different designs to explore alternate layouts and ensure we continue to meet the competition regulations for this component."

In particular, members of TBR need to share data and they have written the software to create their own product data management (PDM) tool, called Bath Automatic Parts System (BAPS), which runs on its own server and enables students to visualize aspects of their own project and share parts. "BAPS automatically generates part numbers in the specific format required by our competition rules and saves the parts to our central server, making data sharing between team members much more efficient, whilst giving us an appreciation of common industry practice," says Turton.



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Aydin Nassehi
Lecturer and CIRP Research
Affiliate

Solutions/Services

Solid Edge
www.siemens.com/solidedge
NX
www.siemens.com/nx

Customer's primary business

A leading UK university with an international reputation for teaching and research excellence, the University of Bath received its Royal Charter in 1966.
www.bath.ac.uk

Customer location

Bath
United Kingdom

Partner

Majenta PLM

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Preparing engineers for the real world

According to Jeff Barrie, the primary benefit of access to Solid Edge and NX is the opportunity to experience how engineering is undertaken in the real world. He expands: "From my own industrial experience, I recognize that new graduates sometimes find working at an engineering company rather a challenge because they have to follow a very specific modeling methodology with strict quality processes. By having Siemens PLM Software CAD solutions readily available as they undertake their projects, students at the University of Bath become familiar with a variety of real-world approaches."

In addition, he regards the availability of CAD as highly advantageous because it obliges users to consider their design intent. "It really forces students to think about why they are making certain decisions. One reason, for example, is that they may have to pass information on to their group members. For this reason, the third-year design and business project typically requires students to share CAD data."

Barrie cites synchronous technology as another benefit. "In the past, Solid Edge gave the user a choice of either a traditional history tree or synchronous modeling. With the latest version it is possible to break out of history tree into synchronous

modeling for just one feature and assess the impact of that particular change, for example, to a wing. This makes it very quick and easy to understand and visualize the options at any point in the design process without the danger of knocking out dependent features. Synchronous modeling can cope because it is history-free. It also allows bespoke editing, which is needed for some special situations.

"I always teach students to follow the history tree method first, because it ensures they gain a strong understanding of design intent, any constraints originally applied and a record of past decisions. Later they really do appreciate the benefits of synchronous modeling. Having exposure to both approaches develops their CAD skill and expertise."

Barrie sums up the ethos of engineering study at University of Bath: "Recognizing what has gone wrong and identifying how to fix it is just as important as getting it right first time when learning new skills. Having access to CAD technology from Siemens PLM Software notably enhances the overall learning experience of our students."

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