Engineering courses usually ask students to solve toy problems using limited types of software tools. There is a need for classes that teach students the entire project workflow, using various computational engineering tools, so they can better understand the way projects work in industry—and become better prepared for their careers.

— Professor Kenji Shimada
Carnegie Mellon University

Connecting students with industrial-grade experience

Engineering courses typically have a narrow focus. They educate students about one or two aspects of the product development lifecycle—conceptual design or manufacturing, for instance. And students are typically provided basic, narrowly focused software tools that are often out of date compared to what they’ll use in the working world after graduation.

"Other courses only teach you software basics," says Carnegie Mellon Ph.D. student Meghan Chandarana, who’s focused on robotics research. "You don’t get to solve real-world problems or use a ton of different software packages."

Carnegie Mellon Professor Kenji Shimada agrees. “Engineering courses usually ask students to solve toy problems using limited types of software tools,” he says. “There is a need for classes that teach students the entire project workflow, using various computational engineering tools, so they can better understand the way projects work in industry—and become better prepared for their careers.”

Hands-on learning, powered by Autodesk

In partnership with Autodesk, in 2012 Shimada designed a new graduate-level course, called “Introduction to CAD/CAE Tools.” The class gives students a taste of the kinds of challenges they’ll face when they go to work in industry, using not just CAD/CAE tools, but also conceptual sketching and rendering tools.

“Students have to design components of automotive seats,” says Shimada. “We give them an actual full-scale CAD model of a car seat, but take out the seat-adjustment mechanism. They have to design a new mechanism to integrate with the original while meeting real-world constraints.”

Students learn conceptual design, detailed design, and engineering analysis using Autodesk® software packages, including Autodesk® SketchBook® Designer 2013, Autodesk® Inventor® Professional 2013, Autodesk® Showcase® 2013, Autodesk® Simulation Multiphysics 2013, and Autodesk® Inventor® Publisher 2013.

Redesigning automotive seats—and an engineering class

With help from Autodesk, Carnegie Mellon students get valuable hands-on computational engineering experience.
Professor Shimada’s students use real-world data to solve real-world problems

"In the first half of the course, students use CAD tools to design the new component. In the second half, they optimize the CAD design using CAE packages," Shimada explains. "Throughout both halves, they work in teams, just like they will in industry. And they have to present their project to the class, just like a design review in industry. It’s not a toy problem that they solve, but a real-world problem."

Making the problem especially realistic is the real-world, automotive-seat design data provided by Autodesk. "We wanted the course to be as much like the real world as possible," says Shimada. "Not only does Autodesk provide all the tools for the course, it gives us assembly data for an actual automotive seat. That kind of data, which is very difficult to access, allows students to solve the same kinds of problems they’ll face in industry."

Autodesk also provides Shimada and his students in Introduction to CAD/CAE Tools access to cloud computing resources via Autodesk® 360. "Moving forward, running simulations in the cloud will be the way to go," says Shimada. "You can simulate multiple scenarios simultaneously to optimize your design, and it won’t tie up your computer—even if they take hours to run."

Helping students supercharge their careers

Engineering students are flocking to Introduction to CAD/CAE Tools. "The typical Carnegie Mellon engineering class has 30 or so students. This class has more than 70 students," says Shimada. "The second time the course was offered, I had to waitlist almost 30 students until the university found a bigger classroom."

Demand for the course is high because students understand the value of solving problems across the product development lifecycle using real-world tools and data. According to Shimada, a number of his students earned internships in the automotive industry in part because of the valuable experience they gained using Autodesk solutions in the Introduction to CAD/CAE Tools class.

"You learn the software better than you would in a typical class," says Carnegie Mellon MS student Thimal de Alwis. "I’ll be doing structural analysis with a company that is considered an industry leader after I graduate. After taking this course, I feel comfortable about entering industry."

"We started the course with Autodesk Sketchbook. It was cool to do conceptual design like they do in industry," adds Chandarana. "We learned more nuances of the software than we would in other courses. It definitely makes us more marketable job candidates because other students don’t learn finite-element and dynamic-simulation packages in great depth."

Autodesk also made it easier for Shimada and his staff to prepare for the course. "Autodesk’s multiphysics simulation tool was totally new to us," Shimada says. "Before the start of the course, the faculty and teaching assistants went to a weeklong training on the software. As a result, instead of having to learn the software at the same time as we were teaching the course, we could focus on core course content. It was extremely helpful to us, and beneficial to the students too."

Shimada encourages other professors to use his course as a model, and take advantage of the extensive software and educational content offered by Autodesk. As he puts it, "It’s a great way to offer students a more real-world approach to learning engineering."

Visit Autodesk’s Education Community

Autodesk grants students and educators free* access to the latest versions of Autodesk software for personal use from the Education Community. Autodesk learning materials, including the Intro CAD and Tools curriculum featured in this case study, are available at www.autodesk.com/edcommunity.

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Carnegie Mellon University

An example of tutorial problems for computational fluid dynamics (CFD).

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Students optimize shapes based on structural analysis.