

Clarkson University Brings Consistency to Engineering Curriculum by Standardizing on MathWorks Tools

Aspiring engineers are often uncertain which discipline to pursue when they begin their undergraduate studies. Universities strive to make their students' decisions easier by offering challenging but consistent courses that address both theory and practice.

Today, all departments within the Wallace H. Coulter School of Engineering at Clarkson University use MathWorks tools as the standard software environment in a freshman course that introduces and applies engineering concepts in a multidisciplinary lab setting.

“Standardizing on MathWorks tools and instituting a common freshman course has enabled us to create a consistent experience for all students across the school of engineering,” says Jim Carroll, associate professor, Department of Electrical and Computer Engineering at Clarkson University.



Students using MathWorks tools with TI C2000 processors.

Supporting many software products also increased costs for the university in terms of maintenance, training, and system resources. Because the software was also required for out-of-class homework assignments, students had to purchase licenses for each instructor-selected software package.

THE SOLUTION

By standardizing on MathWorks tools, Clarkson University has prepared first-year students—regardless of engineering discipline—for upper-level classes that require MATLAB®, Simulink®, and related products.

“By standardizing on MathWorks tools, all of our freshman engineering students are exposed to the same topics and obtain the knowledge they need to function at a high level,” says Carroll.

Although MathWorks tools are used across all of the engineering disciplines, they are most prevalent through the electrical engineering courses, beginning with the ES100 prerequisite.

In one of Carroll's ES100 computer lab lectures, his students solve a set of equations that determine the maximum power transfer to a resistive load. They begin by writing a

THE CHALLENGE

To unify the freshman curriculum across all engineering departments

THE SOLUTION

Standardize on MathWorks tools to create multi-disciplinary labs

THE RESULTS

- University reduces software costs by thousands of dollars
- Unified curriculum helps students choose appropriate discipline
- Students save on software costs

THE CHALLENGE

Clarkson University sought to unify the freshman curriculum across their engineering departments by standardizing on software that students would use throughout their studies and, eventually, in industry.

The software tools selected would also need to engage students in a way that helps them determine which engineering discipline to pursue.

In the past, individual faculty members used various software tools to teach ES100: Introduction to Engineering Use of the Computer.

“Because professors recommended their own software, it was difficult to ensure that engineering students would acquire uniform knowledge of a particular tool or language,” says Carroll.

script using MATLAB, apply MATLAB functions, such as `max()`, and perform indexing to determine the resistive load.

“If my students had to numerically analyze the possible combinations by hand, they would get pretty frustrated,” explains Carroll. “MATLAB connects the students to the topic and lets them explore various possibilities quickly.”

In addition to the lecture component, an integrated lab experience enables students to use MATLAB and the Data Acquisition Toolbox with engineering equipment and instruments. In the lab, students learn how to design, build, test, and document simple circuits, such as a keyless entry system.

“By using MathWorks tools in our lab setting, students can determine whether they prefer the more hands-on aspects of engineering or are more interested in the underlying analysis and design,” says Carroll.

In EE251: Dynamical Systems, sophomores apply class concepts using MATLAB and Simulink to model electrical, mechanical, thermal, and fluid systems.

In the dynamical systems course, Carroll typically assigns a fun class project such as the “Electric Dukes of Hazzard,” in which students “build” an electric car.

In EE321: Systems and Signal Processing, juniors use the Control System and Signal Processing toolboxes to explore conceptual, analytical, and computational issues in communications, signals processing, and controls.

In EE401: Digital Signal Processing, seniors use Simulink with the DSP Blockset to develop DSP applications. They also use Real-Time Workshop® to generate embedded code from Simulink models. They then

“ Knowledge of MathWorks tools is widely sought after by those engineering faculty teaching upper-level courses and performing research. After speaking to our recent graduates, it became even clearer how widely adopted MathWorks tools are in industry. ”

Jim Carroll, Clarkson University

implement the code in real time using the Embedded Target for TI C2000™ DSP.

Awarded a three-year Course, Curriculum, and Laboratory Improvement grant from the National Science Foundation, Clarkson’s Wallace H. Coulter School of Engineering will further enhance its multidisciplinary lab project courses using MathWorks tools.

THE RESULTS

■ **University reduces software costs by thousands of dollars.** Clarkson University saves more than \$10,000 in software costs per year by using a common set of software tools.

■ **Unified curriculum helps students choose appropriate discipline.** By choosing a common set of tools and integrating a lab component, Clarkson University provides a common freshman learning experience that enables students to pursue an engineering discipline of their choice.

■ **Students save on software costs.** “Now, students can transfer between engineering programs without learning or purchasing new software tools,” says Carroll.

To learn more about Clarkson University, visit www.clarkson.edu

APPLICATION AREAS

- Education

PRODUCTS USED

- MATLAB
- Simulink
- Data Acquisition Toolbox
- Control System Toolbox
- Signal Processing Toolbox
- DSP Blockset
- Real-Time Workshop
- Embedded Target for TI C2000™ DSP

www.mathworks.com