

The University of Melbourne Supports New Engineering Curriculum with MathWorks Tools



Engineering students working in a design studio.

THE CHALLENGE

Enable students to solve complex problems across a wide range of disciplines and to support faculty research

THE SOLUTION

Give undergraduate and graduate students and faculty campus-wide access to MathWorks tools

THE RESULTS

- Course planning simplified
- Workplace skills acquired
- Complex concepts visualized, enabling exploration and problem-solving

Recognizing that today's engineers require skills that span a wide range of disciplines, many of the world's top universities are reorganizing their engineering curricula. The Melbourne School of Engineering at the University of Melbourne recently adopted a model in which students complete a broad-based curriculum to earn an undergraduate degree in three years and a specialized Master of Engineering degree two years later.

Campus-wide adoption of MathWorks software has helped support this new model. Students now use MATLAB®, Simulink®, and other MathWorks software as they study basic linear algebra, control systems, signal processing, mechatronics, and other engineering topics.

"MATLAB has proved to be a highly effective tool for training our engineering students," says Dr. Doreen Thomas, Professor and Head of the Mechanical Engineering department. "They have access to MathWorks software from the day they enter the university, and this access has benefited students throughout the entire engineering curriculum, from first-year classes to advanced senior projects and graduate research."

THE CHALLENGE

The curriculum changed significantly with the introduction of two required courses in engineering system design for all freshman engineers. For these courses, Dr. Jamie Evans, Associate Professor and Head of the Electrical Engineering department, needed a dynamic environment to illustrate new concepts and engage the students.

Faculty wanted a platform that students could use for more advanced courses in their undergraduate and graduate years and as they began careers in industry and research. "Engineers tackling design problems require ever greater computational sophistication. Many problems cannot be solved by analytical approaches alone. Students need to complement these approaches with a powerful computing system using simulations and numerical methods," explains Dr. Evans.

THE SOLUTION

The University of Melbourne made MATLAB, Simulink, and companion products available to students and faculty everywhere on campus. Students use

MathWorks tools in coursework in many disciplines, including engineering science, applied mathematics, finance, economics, and medical science.

In a first-semester workshop on fluid mechanics, for example, students use MATLAB to model fluid draining from a bucket and to analyze data from lab experiments. Later in the course, the students analyze stress in static structures using MATLAB and then work in teams to configure a giant slingshot. They solve equations of motion and calculate optimal parameters in MATLAB before testing their slingshots on physical targets.

In second-year courses in engineering analysis, Dr. Thomas illustrates linear algebra concepts, including eigenvectors, diagonalization, and sequences and series, using MATLAB and Symbolic Math Toolbox™.

In their final year of study, mechanical and electrical engineering students complete year-long technical projects, many of which use MathWorks tools. Completed projects are showcased to industry, school students, and the wider community at the university's annual Meridian and Endeavour Exhibitions, which are cosponsored by The MathWorks.

In addition, because MathWorks tools are integrated into the curriculum, students and faculty can use them to collaborate on research projects. Dr. Thomas, for example, worked with a Ph.D. student on an underground mine project in which they used MATLAB to determine the best location for the shaft and tunnels.

University of Melbourne faculty continue to integrate MathWorks tools into their curricula; a new course in engineering math will likely have close to 1000 students using MATLAB.

APPLICATION AREAS

- Academia
- Control system design and analysis
- Mechatronics

PRODUCTS USED

- MATLAB®
- Simulink®
- Symbolic Math Toolbox™

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Students pick up MATLAB much faster than a low-level language such as C. They can try things out in MATLAB and get immediate, visual feedback. When we couple MATLAB with hands-on activities, we have the full progression from theory to numerical computation to lab experiments.

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Dr. Jamie Evans, University of Melbourne

THE RESULTS

▪ **Course planning simplified.** “Campus-wide access to MathWorks tools has made it much easier to add courses to our curriculum,” says Dr. Thomas. “In the past we might not have introduced a computationally intensive course in engineering math; knowing that all the students would have access to MATLAB made this course possible.”

▪ **Workplace skills acquired.** “Because we knew that students would be using MathWorks software in the workplace, we felt that it was vital to introduce the software into our curriculum,” says Dr. Thomas. “And not only electrical and mechanical engineers, but chemical, civil, and biomedical engineers are learning how to apply these tools in their own fields.”

▪ **Complex concepts visualized, enabling exploration and problem-solving.** “When students are learning a new theory or when I’m testing a new idea in my research, the ability to quickly visualize the results in MATLAB is invaluable,” says Dr. Evans. “MATLAB is a great environment for quickly exploring ideas, working in groups, and solving problems creatively.”

Learn more about engineering at the University of Melbourne:
www.eng.unimelb.edu.au