

Engineering Problem Solving with Computers

Matlab Version

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Course Overview

Introduction to the Course

Engineering Problem Solving with Computers is intended to help you develop the skills necessary to solve the increasingly complex problems facing engineers today. This version focuses on the use of Matlab for carrying out a variety of solutions. It begins with an introduction to Matlab, assuming no prior knowledge, and progresses towards more advanced applications. The course covers methods of solving linear and nonlinear systems, optimization techniques, and approaches to solving systems of differential equations that govern many engineering problems. A case study, problem-based approach is used.

We will use the most recent release of Matlab, but just about any version will suffice. We will, for the most part, be using features that have existed for a very long time, so just about any version will work. Some function names will have changed, but we can work around these issues.

Your Instructor

Jake Blanchard, PhD, is a professor in the Engineering Physics Department at the University of Wisconsin–Madison. He holds a BS in mechanical engineering, an MS in engineering, and a PhD in nuclear engineering, all from UCLA. He has published more than 80 articles in refereed journals in several engineering fields, including fusion technology, solid mechanics, materials and applied physics. Dr. Blanchard received the prestigious UW Distinguished Teaching Award in 2002.

Goals of the Course

After completing this course, you should be comfortable solving engineering problems using numerical analysis methods including algebraic systems, differential equations, curve-fitting and optimization.

General objectives include:

- Learn the fundamentals of Matlab
- Understand solution techniques for several equation types
- Understand the level of difficulty for various problem types
- Be able to select the appropriate tools for solving different types of engineering problems
- Understand the advantages and disadvantages of using computers to solve engineering problems

Course Materials

Textbooks

There is no textbook for this course. If you find yourself needing additional resources, one of the optional texts listed below might be of value.

Matlab books:

There are many Matlab books intended for engineers. Here are a few of them, along with some general references:

The Matlab Primer, 6th edition, Sigmon, K. and Davis, T.A., CRC Press, 2002. [ISBN-10: 1584882948 ISBN-13: 978-1584882947]
(Available online at http://www.mathnetbase.com/books/720/C2948_PDF_SEC.pdf, a subscription is required.)

Basics of Matlab and Beyond, Knight, A., CRC Press, 2000. [ISBN-10: 849320399]
(Available online at http://www.mathnetbase.com/books/760/2039_PDF_Part-I.pdf a subscription is required.)

Introduction to Matlab, Chandler, G., The University of Queensland.
(Available online in EEVL at <http://www.maths.uq.edu.au/~gac/mlb/mlb.html>)

Getting Started with Matlab 5: A Quick Introduction for Scientists and Engineers. Pratap, R., Oxford University Press, 1998. [ISBN-10: 0195129474 ISBN-13: 978-0195129472]

Introduction to Matlab for Engineers and Scientists, Etter, D.M., Prentice Hall, 1995.
[ISBN-10: 0135197031 ISBN-13: 978-0135197035]

MatLab 5 for Engineers, 2nd Edition, Biran, A. & Breiner, M., Prentice Hall, 1999.
[ISBN-10: 0201360438 ISBN-13: 978-0201360431]

MatLab for Engineering Applications, Palm, W.J., McGraw-Hill, 1998. [ISBN-10: 0070473307 ISBN-13: 978-0070473300]

Students may obtain these books from online booksellers such as <http://www.amazon.com> which will ship in 2-3 days if in stock. Or order through the University Bookstore in Madison <http://www.univbkstr.com>. You may also consider <http://www.bookfinder.com> for used books.

Course Schedule

LESSON 1: INTRODUCTION TO MATLAB

LESSON 2: USER-DEFINED FUNCTIONS

LESSON 3: LINEAR SYSTEMS, CURVE FITTING, AND MINIMIZATION

LESSON 4: ROOT-FINDING, QUADRATURE, AND INTERPOLATION

LESSON 5: SIGNAL PROCESSING

LESSON 6: DIFFERENTIAL EQUATIONS

LESSON 7: MONTE CARLO ANALYSIS

LESSON 8: TOOLBOXES FOR MATLAB

LESSON 9: COMPARING MATLAB TO EXCEL