

Foundations of Engineering with MATLAB[®] 7

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Dedicated to my father, Walter, for his inspiration,

to my mother Lillian for her direction,

to my in-laws Barbara and Lee for their endless
assistance,

to my kids, Darcie and Brandon, who deserved to see
me a whole lot more than they did over the past two
years,

and particularly to my wife Beth, the most patient
person in the world

Preface

Practical MATLAB®

This textbook has been written after many frustrating hours of searching for an appropriate reference for our freshmen-based engineering problem solving/computer programming class at the University of Alabama. For engineering curricula, MATLAB® clearly has many advantages over traditional languages like FORTRAN. Unfortunately, the available texts tend to focus far too much on MATLAB syntax and not enough on problem solving, or they focus on problem solving without providing a good summary of MATLAB capabilities. Summaries of syntax are certainly important, but the problem with this is that students rarely relate to the system, and inevitably forget everything within seconds of leaving the course. Unless students gain a clear picture of the benefits that MATLAB has to offer for their early courses, they will likely not use it again until forced to do so in junior- or senior-level classes (by which time they will need to relearn the entire system).

The philosophy of this book is to immerse the student in the MATLAB environment, and then present situations where MATLAB solutions are the most appropriate. The focus is on development of practical problem solving skills for applications that most students will likely see in their engineering education. As part of this process, the students will learn to identify classes of mathematical systems and how MATLAB programs can solve them easily.

From the perspective of physical processes, the book will typically use simple ideas and will show how simple ideas lead to complicated systems very quickly. However, the many examples will guide students through the parameter identification and equation formulation process on a detailed, step-by-step basis, and then provide detailed MATLAB scripts to solve the resulting systems.

The primary objectives of a course based on this book are to:

- Help students become comfortable in the MATLAB working environment
- Introduce the students to good problem solving habits
- Reinforce fundamental physical and mathematical concepts
- Provide a comprehensive overview of MATLAB capabilities

- Promote productive MATLAB use by showing how scripts can be self-documenting, and how the scripts substantially reduce the process of problem solution
- Promote the efficient use of MATLAB commands

The last two items, concerning MATLAB efficiency and productivity, will come from students embracing and reusing the examples as much as possible. For the most part, students will rarely need to develop complicated scripts on their own. Most of the exercises in the book, once formulated correctly, will be solvable with minor modification of existing codes. If the students can follow the examples and understand some fundamentals about the MATLAB environment, they will be able to do all the MATLAB coding required for the course. The primary challenge for the students will be to identify the example scripts which most closely resemble their respective problems.

Students will not be experts at MATLAB programming or problem solving at the end of the course. Students should, however, have a good grasp of MATLAB basics and should be in position to use the package effectively after the course.

Advice for Students

The only way to gain skill in problem solving and with MATLAB is to practice a lot. This course will give ample opportunity to do this.

1. Students should carefully read each section prior to the class in which the material will be discussed.
2. Students should look over example exercises and read homework assignments prior to class. Similarities between the examples and the problems that you have been asked to solve should be identified.
3. This course covers a lot of different physical concepts. Students are not expected to be experts on the concepts. However, students should have a sufficient understanding to follow examples.
4. Students should get in the habit of using the example MATLAB scripts as a basis for their own solutions. Why re-invent the wheel? Adapt the MATLAB scripts to your problems, changing as little as possible to get your problem solved. How often do students get encouraged to copy?

Also, be sure to check out Table 3.1 to understand the color coding of MATLAB commands and program statements used throughout the book.

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