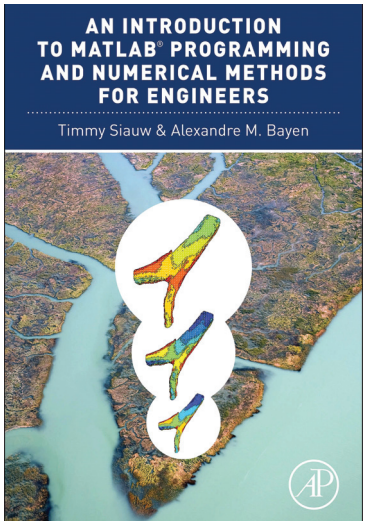
Review

Colin Caprani enjoys this introduction to MATLAB, which would make an ideal companion for engineers interested in starting to program.

An Introduction to MATLAB Programming and Numerical Methods for Engineers



Authors: T. Siauw and A. M. Bayen
Publisher: Academic Press
Price: £48.99
ISBN: 978-0-124202-28-3

With increasingly complicated algorithms becoming a feature of modern engineering, the numerical tools that engineers use are evolving accordingly. For many routine calculations, spreadsheet programs, most notably Microsoft Excel, are ubiquitous in the design office. However, for more advanced work Excel (even when coupled with VBA) can run out of steam. Typical problems requiring more advanced computational power include large datasets with millions of entries, matrix computations, numerical differentiation and integration, and parsing of files (text or binary) with a known structure. Many of these problems will be found in engineering projects requiring advanced or first-principles work for which a spreadsheet or bespoke software package may not be available or is unsuited.

In the last decade or so, MATLAB (**mat**rix **lab**oratory, Mathworks, Inc) has become one of the most used tools for high-level computation (along with its open-source clone, Octave). It has a relatively easy programming language to learn, but is backed with incredibly powerful built-in functions (e.g. fft) and add-on toolboxes (e.g. wavelets). Indeed, reading many of the latest journal articles reveals that MATLAB is the tool of choice for many researchers. This is because its combination of ease of use and power is hard to beat.

Against this backdrop, undergraduate programs are increasingly using MATLAB as the reference program for students to use throughout their course. Indeed, this book by Siauw and Bayen emerged from teaching a common first-year module to students of different science and engineering disciplines at the University of California, Berkeley. As such, the book assumes no knowledge of MATLAB, or programming, or of numerical methods. It is very well targeted then at those who wish to learn from scratch. And there are many interesting teaching approaches taken in the book to help readers of different learning styles. Features like “Try It!”, “Tip!”, numerous examples, program patterns, end-of-chapter summaries, and an operators section all make it easy to pick up the concepts. The real gem though is the end-of-chapter problems: there is a wide range of problem difficulties and a range of ways of tackling them. Some are to be handwritten, others are command prompt entries (>>), programs (*.m files), and a real bonus is the problems that intentionally cause an error – exposing the reader to common errors that without prior notice could confound.

> "IN SHORT THEN, THIS IS AN EXCELLENT FIRST BOOK"

Part 1 of the book gives an introduction to programming concepts. Given the ease of the MATLAB language, this section could easily be a gateway to programming in all languages, since the constructs are often common, if not the syntax of commands. Part 2 gives an overview of numerical methods that engineers may often need to use. Indeed, many of these will already be familiar to the mature reader, but application in MATLAB serves to show the power of the program.

There are many introductory books about MATLAB and numerical methods in engineering, but one aspect that appeals about this book is the depth and wide interest displayed by the authors, most

notably in the problems. Often constrained by the target audience in the main text, the authors hint at far wider applications in the problems section. For example, the mathematician Ramanujan's approximation for pi is found at the end of Chapter 1! Of relevance to structural engineers, the basic single-degree-of-freedom model in structural dynamics is given an outing in the last chapter on solving ordinary differential equations.

As an experienced MATLAB programmer, I was really pleased to see addressed many of the key areas of difficulty for students. Highlights in this regard include Chapters 7–9 covering good coding practice, the way a computer actually stores numbers, common errors, and debugging approaches. These are key skills often overlooked. In contrast, Part 2 does not sparkle quite as much as Part 1, and can meander sometimes into detailed derivations. It's a difficult line for any author – too much depth versus enough depth, especially given the target level – and the authors cross this line and back again a few times. A fairly gentle criticism then is that the authors could have included a 'further reading' section at the end of each chapter, thereby avoiding derivations, and pointing the interested reader to more in-depth work on a particular topic.

In summary, to engineers interested in starting to program, both MATLAB and this book are ideal companions. For those with programming experience in another language, you'll find Part 1 a good gateway to MATLAB. For an initial introduction to numerical methods, Part 2 is also very good, and MATLAB a very good way to start. In short then, this is an excellent first book, but as you need to deepen your knowledge into specific topics, other resources will be required.

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