

Introduction

How to Use This Book

The goal of this book is to teach MATLAB by examples, that is, by showing how to solve problems by designing an algorithm and implementing it in MATLAB. Cleve Moler developed MATLAB originally for teaching linear algebra. MATLAB is the acronym for “MATrix LABoratory.” Today MATLAB is a widely used computer language for technical computing. This book is not meant to cover the whole range of MATLAB. Rather it is an introduction to motivate the students to learn this programming language.

The book is based on notes that have been written for a beginner course of 7 weeks with 3 hours of lectures and exercises per week, given at Qian Weichang College at Shanghai University in the fall of 2014. I am indebted to Ying Su for her help during that course and to Prof. Chuan-Qing Gu who invited me to lecture this course.

Some examples were taken from the books [3], [4] and from the freely available online book of the MATLAB creator [8].

Most programs developed in this course can also be run using the public domain software GNU OCTAVE.¹ The OCTAVE language is quite similar to MATLAB so that programs are portable.

Programming environments like MATLAB are very large systems. Getting familiar with the graphical user interface of MATLAB is for a beginner already a challenge. Chapter 1 gives a few hints how to get organized.

It is not possible to get familiar with the whole MATLAB system in one semester, not even in several semesters! My approach is therefore based on *learning by doing*. Given a problem, one has to find a way to solve it using MATLAB. My experience is that the students memorize much better MATLAB commands and programming structures when they *use it themselves*. Therefore it is important to do the exercises before consulting Chap. 10 where all solutions are given.

¹<http://www.gnu.org/software/octave/>.

Several topics of the book are taken from my area of interest: Scientific Computing. The emphasis is, however, on programming. Showing how to compute some elementary functions using the four basic operations (Chap. 4) is just a nice programming exercise. Computations are mostly done with the usual IEEE arithmetic implemented in MATLAB. Chapter 2 describes the principles of this finite arithmetic. In Chap. 5 we use some of MATLAB's integer arithmetic operations by working with unsigned integers. We do not make use of any of the many toolboxes of MATLAB, and especially we do not use Symbolic Math Toolbox Functions. It is important to tell the students the difference when computing with a computer algebra system versus using standard IEEE arithmetic.

The other book which also teaches MATLAB but focuses more on scientific computing is [9].

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Walter Gander

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A Problem Solving Approach

Gander, W.

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