

Preface

Our initial objective in developing this book was to report on our experience in numerical techniques for solving partial differential equation problems, using simple programming environments such as MATLAB, OCTAVE, or SCILAB. Computational tools and numerical simulation are particularly important for engineers, but the specialized literature on numerical analysis is sometimes too dense or too difficult to explore due to a gap in the mathematical background. This book is intended to provide an accessible introduction to the field of dynamic simulation, with emphasis on practical methods, yet including a few advanced topics that find an increasing number of engineering applications. At the origin of this book project, some years ago, we were teaming up with Bill Schiesser (Lehigh University) with whom we had completed a collective book on Adaptive Method of Lines. Unfortunately, this previous work had taken too much of our energy, and the project faded away, at least for the time being.

Time passed, and the book idea got a revival at the time of the post-doctoral stay of Carlos in the Control Group of the University of Mons. Carlos had just achieved a doctoral work at the University of Vigo, involving partial differential equation models, finite element techniques, and the proper orthogonal decomposition, ingredients, which all were excellent complements to our background material.

The three of us then decided to join our forces to develop a manuscript with an emphasis on practical implementation of numerical methods for ordinary and partial differential equation problems, mixing introductory material to numerical methods, a variety of illustrative examples from science and engineering, and a collection of codes that can be reused for the fast prototyping of new simulation codes.

All in one, the book material is based on past research activities, literature review, as well as courses taught at the University of Mons, especially introductory numerical analysis courses for engineering students. As a complement to the text, a website (www.matmol.org) has been set up to provide a convenient platform for downloading codes and method tutorials.

Writing a book is definitely a delicate exercise, and we would like to seize this opportunity to thank Bill for his support in the initial phase of this project. Many of his insightful suggestions are still present in the current manuscript, which has definitely benefited from our discussions and nice collaboration.

Of course, we also would like to express our gratitude to our colleagues at UMONS and at IMM-CSIC (Vigo), and particularly Marcel, Christine, Antonio, Julio, Eva, and Míriam, and all the former and current research teams, for the nice working environment and for the research work achieved together, which was a source of inspiration in developing this material. We are also grateful to a number of colleagues in other universities for the nice collaboration, fruitful exchanges at several conferences, or insightful comments on some of our developments: Michael Zeitz, Achim Kienle, Paul Zegeling, Gerd Steinebach, Keith Miller, Skip Thompson, Larry Shampine, Ken Anselmo, Filip Logist, to just name a few.

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