Preface

Emerging as the mathematical expression of principles of conservation, conservation laws have proven themselves to provide effective and accurate predictive models of our physical world. However, their solution, whether done mathematically or by computational techniques, remains a substantial challenge with many questions left open.

Driven by the importance of such models, extensive research during the past four decades has led to substantial advances in our understanding of such models and, in particular, the development of robust and accurate computational techniques to effectively solve such problems. The goal of this text is to offer a contemporary, in-depth introduction to central computational techniques for conservation laws. While it will be grounded in a discussion based on mathematical ideas and insight, we strive to maintain a focus on practical aspects of these methods, their implementation, and their application.

Computational methods only come to life when being expressed in software. Throughout the text, MATLAB is used to illustrate the many different techniques being discussed. To enable the reader to recreate the results in the text and gain additional experiences, all software, along with additional resources, is available at www.siam.org/books/cs18.

This text is dedicated to two people, both carrying the name of David. David Gottlieb, a professor of applied mathematics at Brown University, USA, until his untimely passing in 2008, was my mentor and colleague at Brown University during many of my formative years. However, he taught me so much more than computational mathematics. By being an almost impossible example to follow, he shared, through our many conversations and his friendship, his deep sense of humanism with me. These lessons, whether related to mathematics or to life itself, continue to inspire me in my personal and my professional life.

A second source of inspiration and curiosity continues to be my son, David. Him being part of my life has opened my eyes to the playfulness and an unquestioned joy that one so easily forgets. Yet these are elements that are so essential in our short lives. He continues to bring a smile to my daily life, a life that would be poorer without him.

I would also like to thank a number of colleagues who have been instrumental for the completion of this text. A special thank you goes to Paolo Gatto, who provided detailed and unfiltered feedback on all parts of the text. This has undoubtedly helped improve the quality and readability of the text. Let me also express my gratitude to Sigal Gottlieb and Eitan Tadmor, who generously shared their views on earlier stages of the text. Their feedback helped shape the overall structure of the text in essential ways. The careful reading of earlier drafts by anonymous referees likewise helped to clarify numerous issues and reduced the number of misprints and inaccuracies. Needless to say, remaining mistakes and misprints are results originating solely from my shortcomings.

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