

Preface

The purpose of this book is to introduce procedures for the analysis of signals and for the solution of inverse problems in engineering and science. The literature on these subjects seldom combines both; however, signal processing and system analysis are intimately interconnected in all real applications. Furthermore, many mathematical techniques are common to both signal processing and inverse problem solving.

Signals and inverse problems are captured in *discrete* form. The discrete representation is compatible with current instrumentation and computer technology, and brings both signal processing and inverse problem solving to the same mathematical framework of arrays.

Publications on signal processing and inverse problem solving tend to be mathematically involved. This is an introductory book. Its depth and breadth reflect our wish to present clearly and concisely the essential concepts that underlie the most useful procedures readers can implement to address their needs.

Equations and algorithms are introduced in a conceptual manner, often following logical rather than formal mathematical derivations. The mathematically minded or the computer programmer will readily identify analytical derivations or computer-efficient implementations. Our intent is to highlight the intuitive nature of procedures and to emphasize the *physical interpretation* of all solutions.

The information presented in the text is reviewed in parallel formats. The numerous figures are designed to facilitate the understanding of main concepts. Step-by-step implementation procedures outline computation algorithms. Examples and solved problems demonstrate the application of those procedures. Finally, the summary at the end of each chapter highlights the most important ideas and concepts.

Problem solving in engineering and science is hands-on. As you read each chapter, consider specific problems of your interest. Identify or simulate typical signals, implement equations and algorithms, study their potential and limitations, search the web for similar implementations, explore creative applications . . . , and have fun!

First edition. The first edition of this manuscript was published by the American Society of Civil Engineers in 1998. While the present edition follows a similar structure, it incorporates new information, corrections, and applications.

Acknowledgments. We have benefited from the work of numerous authors who contributed to the body of knowledge and affected our understanding. The list of suggested reading at the end of each chapter acknowledges their contributions.

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