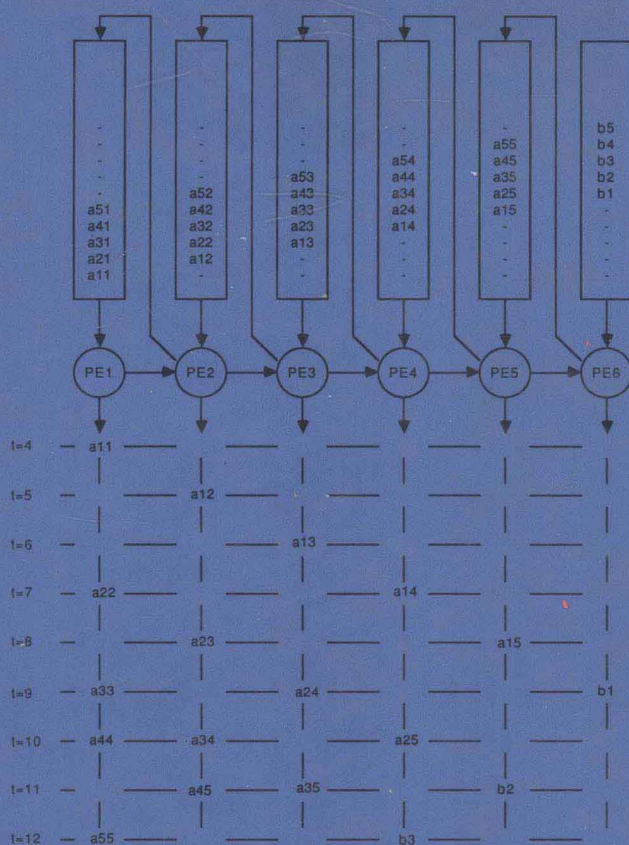


Signal Processing Handbook



edited by
C. H. Chen

Signal Processing Handbook

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Preface

During the last twenty-five years, there has been enormous progress in the theory, development and applications of signal processing. This progress is due largely to rapidly increased computational power at greatly reduced costs. Because of this, most signal processing functions have been shifted from analog to digital forms. Digital signal processing thus constitutes a major part of this book.

The motivation for preparing this book is to provide readers, especially practicing engineers, with state-of-the-art knowledge in various aspects of signal processing. Although a large number of signal processing books have been published, along with journals and conference proceedings in signal processing, a handbook of this nature is much needed to provide introductory and systematic treatments of many interrelated subjects in a single volume. Each chapter begins with an introduction of a topic and then presents the latest progress. In fact, many new results are included in almost every chapter. Most topics of signal processing are examined in this volume; only certain peripheral topics such as knowledge-based signal processing and neural net signal processors are not covered. Further research progress in both topics is needed before a complete coverage can be made.

The first four chapters deal with the fundamentals of signal processing, including an overview, analog-to-digital conversion, digital filters, and the discrete Fourier transform. Chapter 5 presents some existing and new high resolution 1-D and 2-D spectral estimation algorithms. The next three chapters deal with the new signal processing architectures using systolic arrays and VLSI. The syntactic signal processing of Chapter 9 is a unique approach to signal processing. Image processing is presented in the next two chapters with emphasis on inspection and robotics

applications. A brief digression from digital processing is the important subject of optical signal processing, presented in Chapter 12.

The second half of the book focuses on digital signal processing applications. The needs in practical applications have been the driving force behind the progress in signal processing. The theory and practice of adaptive signal processing are presented in Chapter 13. The two primary subjects of sonar signal processing, namely time delay beamforming and coherence/time delay estimation, are presented in the next two chapters. They are followed by radar, speech, and vibration signal analysis in Chapters 16–18. Historically, many signal processing algorithms were first developed for processing seismic signals. Chapters 19 and 20 deal with signal processing of seismic data based on land and ocean respectively. An emerging new application of signal processing is in nondestructive evaluation of materials as described in Chapter 21. In recent years, there has been a greatly increased emphasis on communications making extensive use of digital signal processing; as presented in Chapter 22, the impact of digital signal processing on telecommunications is quite evident. Although the book does not get into details of processing with biomedical waveforms such as EEG, ECG, EMG, and so forth, the last chapter, on signal processing in medical tomography, represents a major advance of digital signal processing in 3-D object reconstructions. The Appendices offer a brief survey of signal processing software packages available in the public domain and program listings for several algorithms. There is no doubt that each topic presented can be expanded into a book by itself, but a concise exposition of these topics in a single volume presents a useful source book to users of signal processing.

The timely publication of this book has resulted from the cooperation of all authors and the coordination provided by the Marcel Dekker publication staff; to all of them I would like to express my deep gratitude. In sustaining my efforts, I am grateful for the support of the Naval Underwater Systems Center, Army Materials Technology Laboratory, Analog Devices, and the Bay State Skills Corporation.

C. H. Chen

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