Digital Spectral Analysis With Applications Prentice Hall Series In Signal Processing

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Digital Spectral Analysis With Applications Prentice Hall Series In Signal Processing ***2019-07-07***

BARKER CONOR

Instrumentation and Applications John Wiley & Sons

This dissertation covers both the theory and practice of estimating the spectrum of signals in noise using digital data. The theory of describing some of the signal processing concepts for digital data are given and various spectral estimation methods are given. The theory of MEM is described in detail using approaches from estimation theory, communication theory, and statistics. The work was intended to give researchers the theory and practice of practical means of spectral estimation using communications or scientific data. The Maximum Entropy Method by John Parker Burg is explained from what was known in 1974-75. KEY WORDS: Calculus-of-Variations, Data Systems, Noise , Spectrum Analysis, Time Series Analysis, Autocorrelation, Computer Programs, Data Windowing, Ergodic Process, Maximum Entropy Method (MEM, Fourier Transformation, Optimum Order of Estimation, Sampling, Spectral Resolution, Statistical Significance Test, Systems Analysis, Wiener-Khinchine Theorem. From The Smithsonian/NASA Astrophysics Data System -- The practical aspects of spectral analysis are contrasted with the mathematical theory. Treatment is limited to ergodic processes and emphasizes data window

and noise effects. The Discrete Fourier Transform (DFT) and Maximum Entropy Method (MEM) are covered extensively both in theory and application with FORTRAN programs and many examples being provided. Several of the chapters are tutorial and discuss the important topics of sampling theory and system analysis. Topics on MEM include a complete calculus-of-variations solution, relationship between MEM and the Wiener-Khinchine relations, spectral resolution, and choosing the optimum order of the estimation. DFT leakage effects are modeled. A statistical significance test was developed to determine the realness of a spectral component. Keywords: Data Systems, Noise (Sound), Spectrum Analysis, Time Series Analysis, Autocorrelation, Computer Programs, Ergodic Process, Fourier Transformation, Sampling, Systems Analysis [less]

Spectral Analysis in Engineering John Wiley & Sons

Along with finite differences and finite elements, spectral methods are one of the three main methodologies for solving partial differential equations on computers. This book provides a detailed presentation of basic spectral algorithms, as well as a systematical presentation of basic convergence theory and error analysis for spectral methods. Readers of this book will be exposed to a unified framework for designing and analyzing spectral algorithms for a variety of problems, including in particular high-order differential equations and problems in

unbounded domains. The book contains a large number of figures which are designed to illustrate various concepts stressed in the book. A set of basic matlab codes has been made available online to help the readers to develop their own spectral codes for their specific applications.

Principles and Applications Prentice Hall

In the framework of Digital Signal Processing, the Parametric Modeling of Signals offers as a natural byproduct a class of Spectral tools, namely the so-called Rational Spectra. This class of Spectra (and their associated Estimators) applies to the case of Stationary as well as Non-Stationary Signals and Random Processes. This important text brings together the significant advances that have been achieved over the last ten years from the confrontation of the theory and its variety of applications.

Engineering Applications Springer Science & Business Media

I became interested in Random Vibration during the preparation of my PhD dissertation, which was concerned with the seismic response of nuclear reactor cores. I was initiated into this field through the cla.ssical books by Y.K.Lin, S.H.Crandall and a few others. After the completion of my PhD, in 1981, my supervisor M.Gera.din encouraged me to prepare a course in Random Vibration for fourth and fifth year students in Aeronautics, at the University of Liege. There was at the time very little material available in French on that subject. A

first draft was produced during 1983 and 1984 and revised in 1986. These notes were published by the Presses Poly techniques et Universitaires Romandes (Lausanne, Suisse) in 1990. When Kluwer decided to publish an English translation ofthe book in 1992, I had to choose between letting Kluwer translate the French text in-extenso or doing it myself, which would allow me to carry out a sustantial revision of the book. I took the second option and decided to rewrite or delete some of the original text and include new material, based on my personal experience, or reflecting recent technical advances. Chapter 6, devoted to the response of multi degree offreedom structures, has been completely rewritten, and Chapter 11 on random fatigue is entirely new. The computer programs which have been developed in parallel with these chapters have been incorporated in the general purpose finite element software SAMCEF, developed at the University of Liege.

Spectral Analysis and Its Applications SIAM

Spectral analysis is widely used to interpret time series collected in diverse areas. This book covers the statistical theory behind spectral analysis and provides data analysts with the tools needed to transition theory into practice. Actual time series from oceanography, metrology, atmospheric science and other areas are used in running examples throughout, to allow clear comparison of how the various methods address questions of interest. All major nonparametric and parametric spectral

analysis techniques are discussed, with emphasis on the multitaper method, both in its original formulation involving Slepian tapers and in a popular alternative using sinusoidal tapers. The authors take a unified approach to quantifying the bandwidth of different nonparametric spectral estimates. An extensive set of exercises allows readers to test their understanding of theory and practical analysis. The time series used as examples and R language code for recreating the analyses of the series are available from the book's website.

Handbook of Digital Signal Processing

Prentice-Hall PTR

Quantum-Mechanical Signal Processing and Spectral Analysis describes the novel application of quantum mechanical methods to signal processing across a range of interdisciplinary research fields. Conventionally, signal processing is viewed as an engineering discipline with its own specific scope, methods, concerns and priorities, not usually encompassing quantum mechanics. However, the dynamics of systems that generate time signals can be successfully described by the general principles and methods of quantum physics, especially within the Schroedinger framework. Most time signals that are measured experimentally are mathematically equivalent to quantum-mechanical auto-correlation functions built from the evolution operator and wavefunctions. This fact allows us to apply the rich conceptual strategies and mathematical apparatus of quantum mechanics to

signal processing. Among the leading quantum-mechanical signal processing methods, this book emphasizes the role of Pade approximant and the Lanczos algorithm, highlighting the major benefits of their combination. These two methods are carefully incorporated within a unified framework of scattering and spectroscopy, developing an algorithmic power that can be exported to other disciplines. The novelty of the author's approach to key signal processing problems, the harmonic inversion and the moment problem, is in establishing the Pade approximant and Lanczos algorithm as entirely algerbraic spectral estimators. This is of paramount theoretical and practical importance, as now spectral analysis can be carried out from closed analytical expressions. This overrides the notorious mathematical ill-conditioning problems with round-off errors that plague inverse reconstructions in those fields that rely upon signal processing. Quantum-Mechanical Signal Processing and Spectral Analysis will be an invaluable resource for researchers involved in signal processing across a wide range of disciplines.

Applications of Digital Spectral Analysis and Monte Carlo Simulations to the Measurement of Signal Characteristics

Courier Dover Publications

Bernard Helffer's graduate-level introduction to the basic tools in spectral analysis is illustrated by numerous examples from the Schrödinger operator theory and various branches of physics: statistical mechanics, superconductivity,

fluid mechanics and kinetic theory. The later chapters also introduce non self-adjoint operator theory with an emphasis on the role of the pseudospectra. The author's focus on applications, along with exercises and examples, enables readers to connect theory with practice so that they develop a good understanding of how the abstract spectral theory can be applied. The final chapter provides various problems that have been the subject of active research in recent years and will challenge the reader's understanding of the material covered.

Automatic Autocorrelation and Spectral Analysis Butterworth-Heinemann Combining clear explanations of elementary principles, advanced topics and applications with step-by-step mathematical derivations, this textbook provides a comprehensive yet accessible introduction to digital signal processing. All the key topics are covered, including discrete-time Fourier transform, z-transform, discrete Fourier transform and FFT, A/D conversion, and FIR and IIR filtering algorithms, as well as more advanced topics such as multirate systems, the discrete cosine transform and spectral signal processing. Over 600 full-color illustrations, 200 fully worked examples, hundreds of end-of-chapter homework problems and detailed computational examples of DSP algorithms implemented in MATLAB® and C aid understanding, and help put knowledge into practice. A wealth of supplementary material accompanies the book online, including interactive

programs for instructors, a full set of solutions and MATLAB® laboratory exercises, making this the ideal text for senior undergraduate and graduate courses on digital signal processing.

Spectral Methods Springer

This work is essentially an extensive revision of my Ph.D. dissertation, [1J. It 1S primarily a research document on the application of probability theory to the parameter estimation problem. The people who will be interested in this material are physicists, economists, and engineers who have to deal with data on a daily basis; consequently, we have included a great deal of introductory and tutorial material. Any person with the equivalent of the mathematics background required for the graduate level study of physics should be able to follow the material contained in this book, though not without elfort. From the time the dissertation was written until now (approximately one year) our understanding of the parameter estimation problem has changed extensively. We have tried to incorporate what we have learned into this book. I am indebted to a number of people who have aided me in preparing this docu ment: Dr. C. Ray Smith, Steve Finney, Juana Sunchez, Matthew Self, and Dr. Pat Gibbons who acted as readers and editors. In addition, I must extend my deepest thanks to Dr. Joseph Ackerman for his support during the time this manuscript was being prepared.

Modern Spectral Estimation CRC Press

The Spectral Analysis of Time Series describes the techniques and theory of

the frequency domain analysis of time series. The book discusses the physical processes and the basic features of models of time series. The central feature of all models is the existence of a spectrum by which the time series is decomposed into a linear combination of sines and cosines. The investigator can used Fourier decompositions or other kinds of spectrals in time series analysis. The text explains the Wiener theory of spectral analysis, the spectral representation for weakly stationary stochastic processes, and the real spectral representation. The book also discusses sampling, aliasing, discrete-time models, linear filters that have general properties with applications to continuous-time processes, and the applications of multivariate spectral models. The text describes finite parameter models, the distribution theory of spectral estimates with applications to statistical inference, as well as sampling properties of spectral estimates, experimental design, and spectral computations. The book is intended either as a textbook or for individual reading for one-semester or two-quarter course for students of time series analysis users. It is also suitable for mathematicians or professors of calculus, statistics, and advanced mathematics.

Spectral Analysis for Physical Applications Emerson Adams PressInc Describes the leading techniques for analyzing noise. Discusses methods that are applicable to periodic signals,aperiodic signals, or random

processes over finite or infiniteintervals. Provides readers with a useful reference when designing ormodeling communications systems.

Theory and Applications Wiley-ISTE
Spectral analysis requires subjective decisions which influence the final estimate and mean that different analysts can obtain different results from the same stationary stochastic observations. Statistical signal processing can overcome this difficulty, producing a unique solution for any set of observations but that is only acceptable if it is close to the best attainable accuracy for most types of stationary data. This book describes a method which fulfils the above near-optimal-solution criterion, taking advantage of greater computing power and robust algorithms to produce enough candidate models to be sure of providing a suitable candidate for given data.

Tensor Analysis Springer Science & Business Media
Tensors, or hypermatrices, are multi-arrays with more than two indices. In the last decade or so, many concepts and results in matrix theory?some of which are nontrivial?have been extended to tensors and have a wide range of applications (for example, spectral hypergraph theory, higher order Markov chains, polynomial optimization, magnetic resonance imaging, automatic control, and quantum entanglement problems). The authors provide a comprehensive discussion of this new theory of tensors. Tensor Analysis:

Spectral Theory and Special Tensors is unique in that it is the first book on these three subject areas: spectral theory of tensors; the theory of special tensors, including nonnegative tensors, positive semidefinite tensors, completely positive tensors, and copositive tensors; and the spectral hypergraph theory via tensors.
Birth-Death Models and Diffusion John Wiley & Sons
Window functions—otherwise known as weighting functions, tapering functions, or apodization functions—are mathematical functions that are zero-valued outside the chosen interval. They are well established as a vital part of digital signal processing. Window Functions and their Applications in Signal Processing presents an exhaustive and detailed account of window functions and their applications in signal processing, focusing on the areas of digital spectral analysis, design of FIR filters, pulse compression radar, and speech signal processing. Comprehensively reviewing previous research and recent developments, this book: Provides suggestions on how to choose a window function for particular applications Discusses Fourier analysis techniques and pitfalls in the computation of the DFT Introduces window functions in the continuous-time and discrete-time domains Considers two implementation strategies of window functions in the time- and frequency domain Explores well-known applications of window functions in the fields of radar, sonar, biomedical signal analysis, audio processing, and synthetic

aperture radar

Quantum-Mechanical Signal Processing and Spectral Analysis Cambridge University Press

This state-of-the-art survey serves as a complete overview of the subject. Besides the principles and theoretical foundations, emphasis is laid on practical applicability -- describing not only classical methods, but also modern developments and their applications. Students, researchers and practitioners, especially in the fields of data registration, treatment and evaluation, will find this a wealth of information.

Digital Spectral AnalysisSecond Edition

FROM THE PREFACE: Many new useful ideas are presented in this handbook, including new finite impulse response (FIR) filter design techniques, half-band and multiplierless FIR filters, interpolated FIR (IFIR) structures, and error spectrum shaping.

Advanced Digital Signal Processing and Noise Reduction Cambridge University Press

Digital Spectral Analysis offers a broad perspective of spectral estimation techniques and their implementation. Coverage includes spectral estimation of discrete-time or discrete-space sequences derived by sampling continuous-time or continuous-space signals. The treatment emphasizes the behavior of each spectral estimator for short data records and provides over 40 techniques described and available as implemented MATLAB functions. In addition to summarizing classical spectral estimation, this text provides

theoretical background and review material in linear systems, Fourier transforms, matrix algebra, random processes, and statistics. Topics include Prony's method, parametric methods, the minimum variance method, eigenanalysis-based estimators, multichannel methods, and two-dimensional methods. Suitable for advanced undergraduates and graduate students of electrical engineering — and for scientific use in the signal processing application community outside of universities — the treatment's prerequisites include some knowledge of discrete-time linear system and transform theory, introductory probability and statistics, and linear algebra. 1987 edition.

Concepts and Applications SIAM

In pioneering work in the 1950s, S. Karlin and J. McGregor showed that probabilistic aspects of certain Markov processes can be studied by analyzing orthogonal eigenfunctions of associated operators. In the decades since, many authors have extended and deepened this surprising connection between orthogonal polynomials and stochastic processes. This book gives a comprehensive analysis of the spectral representation of the most important one-dimensional Markov processes, namely discrete-time birth-death chains, birth-death processes and diffusion processes. It brings together the main results from the extensive literature on the topic with detailed examples and applications. Also featuring an introduction to the basic theory of

orthogonal polynomials and a selection of exercises at the end of each chapter, it is suitable for graduate students with a solid background in stochastic processes as well as researchers in orthogonal polynomials and special functions who want to learn about applications of their work to probability.

Digital Spectral Analysis Cambridge University Press

Outlines the basic principles, advanced instrumentation, applications and future potential of a range of spectral techniques in food analysis. The book introduces new applications of GC-MS, LC-MS, MALDI TOF-MS, GC-FTIR, SFC-FTIR, ATR, and Raman spectroscopy. The book covers the identification and quantitation of food constituents, additives and contaminants.

Numerical Analysis of Spectral Methods Holden Day

Digital Signal Processing, Second Edition enables electrical engineers and technicians in the fields of biomedical, computer, and electronics engineering to master the essential fundamentals of DSP principles and practice. Many instructive worked examples are used to illustrate the material, and the use of mathematics is minimized for easier grasp of concepts. As such, this title is also useful to undergraduates in electrical engineering, and as a reference for science students and practicing engineers. The book goes beyond DSP theory, to show implementation of algorithms in hardware and software. Additional topics covered include adaptive filtering with

noise reduction and echo cancellations, speech compression, signal sampling, digital filter realizations, filter design, multimedia applications, over-sampling, etc. More advanced topics are also covered, such as adaptive filters, speech compression such as PCM, u-law, ADPCM, and multi-rate DSP and over-sampling ADC. New to this edition: MATLAB projects dealing with practical applications added throughout the book New chapter (chapter 13) covering sub-band coding and wavelet transforms, methods that have become popular in the DSP field New applications included in many chapters, including applications of DFT to seismic signals, electrocardiography data, and vibration signals All real-time C programs revised for the TMS320C6713 DSK Covers DSP principles with emphasis on communications and control applications Chapter objectives, worked examples, and end-of-chapter exercises aid the reader in grasping key concepts and solving related problems Website with MATLAB programs for simulation and C programs for real-time DSP