Radar Signal Analysis And Processing Using Matlab | 42cbdf279c4945271244c4a4c06ada96

Radar Signal Processing and Its Applications

Advanced Signal Processing Handbook

Radar Systems Analysis and Design Using MATLAB

Time-Frequency Signal Analysis and Processing

An essential task in radar systems is to find an appropriate solution to the problems related to robust signal processing and the definition of signal parameters. Signal Processing in Radar Systems addresses robust signal processing problems in complex radar systems and digital signal processing subsystems. It also tackles the important issue of defining signal parameters. The book presents problems related to traditional methods of synthesis and analysis of the main digital signal processing operations. It also examines problems related to modern methods of robust signal processing in noise, with a focus on the generalized approach to signal processing in noise under coherent filtering. In addition, the book puts forth a new problem statement and new methods to solve problems of adaptation and control by functioning processes. Taking a systems approach to designing complex radar systems, it offers readers guidance in solving optimization problems. Organized into three parts, the book first discusses the main design principles of the modern robust digital signal processing algorithms used in complex radar systems. The second part covers the main principles of computer system design for these algorithms and provides real-world examples of systems. The third part deals with experimental measurements of the main statistical parameters of stochastic processes. It also defines their estimations for robust signal processing in complex radar systems. Written by an internationally recognized professor and expert in signal processing, this book summarizes investigations carried out over the past 30 years. It supplies
practitioners, researchers, and students with general principles for designing the robust digital signal processing algorithms employed by complex radar systems.

Time-Frequency Signal Analysis with Applications A text and general reference on the design and analysis of radar signals As radar technology evolves to encompass a growing spectrum of applications in military, aerospace, automotive, and other sectors, innovations in digital signal processing have risen to meet the demand. Presenting a long overdue, up-to-date, dedicated resource on radar signals, the authors fill a critical gap in radiotechnology literature. Radar Signals features in-depth coverage of the most prevalent classical and modern radar signals used today, as well as new signal concepts developed in recent years. Inclusion of key MATLAB® software codes throughout the book demonstrates how they dramatically simplify the process of describing and analyzing complex signals. Topics covered include: * Matched filter and ambiguity function concepts * Basic radar signals, with both analytical and numerical analysis * Frequency modulated and phase-coded pulses * Complete discussion of band-limiting schemes * Coherent LFM pulse trains—the most popular radar signal * Diversity in pulse trains, including stepped frequency pulses * Continuous-wave signals * Multicarrier phase-coded signals

Combining lucid explanation, preferred signal tables, MATLAB® codes, and problem sets in each chapter, Radar Signals is an essential reference for professionals—and a systematic tutorial for anyone seeking to broaden their knowledge base in this dynamic field.

Radar Signal Processing and Analysis Using MATLAB® Radar has been an important topic since its introduction, in a military context, during World War II. Due to advances in technology, it has been necessary to refine the algorithms employed within the signal processing architecture. Hence, this book provides a series of chapters examining some topics in modern radar signal processing. These include synthetic aperture radar, multiple-input multiple-output radar, as well as a series of chapters examining other key issues relevant to the central theme of the book.

Radar Signals A self-contained approach to DSP techniques and applications in radar imaging The processing of radar images, in general, consists of three major fields: Digital Signal Processing (DSP); antenna and radar operation; and algorithms used to process the radar images. This book brings together material from these different areas to allow readers to gain a thorough understanding of how radar images are processed. The book is divided into three main parts and covers: * DSP principles and signal characteristics in both analog and digital domains, advanced signal sampling, and interpolation techniques * Antenna theory (Maxwell equation, radiation field from dipole, and linear phased array), radar fundamentals, radar modulation, and target-detection techniques (continuous wave, pulsed linear frequency modulation, and stepped frequency modulation) * Properties of radar images, algorithms used for radar image processing, simulation examples, and results of satellite image files processed by Range-Doppler and Stolt interpolation algorithms

The book fully utilizes the computing and graphical capability of MATLAB® to display the signals at various processing stages in 3D and/or cross-sectional views. Additionally, the text is complemented with flowcharts and system block diagrams to aid in readers' comprehension. Digital Signal Processing Techniques and Applications in Radar Image Processing serves as an ideal textbook for graduate students and practicing engineers who wish to gain firsthand experience in applying DSP principles and technologies to radar imaging.

ELINT An up-to-date analysis of the SAR waveform reconstruction signal theory and its digital implementation With the advent of fast computing and digital information processing techniques, synthetic aperture radar (SAR) technology has become both more powerful and more accurate. Synthetic Aperture Radar Signal Processing with MATLAB® Algorithms addresses
these recent developments, providing a complete, up-to-date analysis of SAR and its associated digital signal processing algorithms. This book introduces the wavefront reconstruction signal theory that underlies the best SAR imaging methods and provides clear guidelines to system design, implementation, and applications. It is a very detailed book that covers a wide range of topics, such as doppler straddling loss, spoofing systems, and radar platform modeling. Featuring coverage on a broad range of topics, this book is geared towards academicians, researchers, and students seeking current research on radar signal processing in the field of aviation.

Fundamentals of Radar Signal Processing Annotation In these times, correctly and quickly identifying a stray electronic blip on a radar screen can have incalculable consequences. Now more than ever, radar electronic intelligence (ELINT) can be the first line of defense for the battlefield or the homeland. Offering new insight into radar signal analysis, this book ensures more reliable and timely gathering of electronic intelligence. Combining and updating the author's two previous definitive books on ELINT, this volume is the indispensable reference for every ELINT professional.

Adaptive Radar Signal Processing Electronics and Instrumentation, Volume 35: Modulation, Resolution and Signal Processing in Radar, Sonar and Related Systems presents the practical limitations and potentialities of advanced modulation systems. This book discusses the concepts and techniques in the radar context, but they are equally essential to sonar and to a wide range of signaling and data-processing applications, including seismology, radio astronomy, and band-spread communications. Organized into 15 chapters, this volume begins with an overview of the principal developments sought in pulse radar. This text then provides a discussion and analysis of a wide range of various modulation systems. Other chapters consider the intrinsic Doppler resolving power of a radar system. This book discusses as well the power illuminating a radar or sonar target that may be comprised of one or more discrete pulses. The final chapter deals with the transmitter-modulator circuits and valves. This book is a valuable resource for electronic engineers and scientists.

Introduction to Radar Analysis, Second Edition An authoritative text covering the key topics, concepts and analytical tools needed to understand modern communication and radar systems. With numerous examples, exercises and computational results, it is an invaluable resource for graduate students in electrical and computer engineering, and practitioners in communications and radar engineering.
Radar Signals Advances in digital signal processing algorithms and computer technology have combined to produce real-time systems with capabilities far beyond those of just a few years ago. Nonlinear, adaptive methods for signal processing have emerged to provide better array behavior, as well as the robustness of conventional algorithms. The challenge remains to develop a concept that exploits the advantages of both—methods that integrate these methods in practical, real-time systems. The Advanced Signal Processing Handbook helps you meet that challenge. Beyond offering an outstanding introduction to the principles and applications of advanced signal processing, it develops a generic processing structure that takes advantage of the similarities that exist among radar, sonar, and medical imaging systems. The book explores radar target detection and pulse integration, emphasizing the constant false alarm rate. It also covers the stretch processor, the moving target indicator, radar Doppler processing, beamforming, and adaptive array processing. Using configurable MATLAB code, this book demonstrates how to apply signal processing to radar applications. It includes many examples and problems to illustrate the practical application of the theory.

Handbook of Radar Signal Analysis 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.

Signal Processing in Radar Systems “The culmination of more than twenty years of research, this authoritative resource provides you with a practical understanding of time-frequency signal analysis. The book offers in-depth coverage of critical concepts and principles, along with discussions on key applications in a wide range of signal processing areas, from communications and optics to radar and biomedicine. Supported with over 140 illustrations and more than 1,700 equations, this detailed reference explores the topics you need to understand for your work in the field, such as Fourier analysis, linear time frequency representations, quadratic time-frequency distributions, higher order time-frequency representations, and analysis of non-stationary noisy signals. This unique book also serves as an excellent text for courses in this area, featuring numerous examples and problems at the end of each chapter.”

Time-frequency Transforms for Radar Imaging and Signal Analysis Digital Signal Processing 101: Everything You Need to Know to Get Started provides a basic tutorial on digital signal processing (DSP). Beginning with discussions of numerical representation and complex numbers and exponentials, it goes on to explain difficult concepts such as sampling, aliasing, imaginary numbers, and frequency response. It does so using easy-to-understand examples with minimum mathematics. In addition, there is an overview of the DSP functions and implementation used in several DSP-intensive fields or applications, from error correction to CDMA mobile communication to airborne radar systems. This book has been updated to include the latest developments in Digital Signal Processing, and has eight new chapters on: Automotive Radar Signal Processing Space-Time Adaptive Processing Radar Field Orientated Motor Control Matrix Inversion algorithms GPUs for computing Machine Learning Entropy and Predictive Coding Video compression Features eight new chapters on Automotive Radar Signal Processing, Space-Time Adaptive Processing Radar, Field Orientated Motor Control, Matrix Inversion algorithms, GPUs for computing, Machine Learning, Entropy and Predictive Coding, and Video compression Provides clear examples and a non-mathematical approach to get you up to speed quickly Includes an overview of the DSP functions and implementation used in typical DSP-intensive applications, including error correction, CDMA mobile communication, and radar systems.

Basic Radar Analysis, Second Edition Developed from the author's graduate-level courses, the first edition of this book filled the need for a comprehensive, self-contained, and hands-on treatment of radar systems analysis and design. It quickly became a bestseller and was widely adopted by many professors. The second edition built on this successful format by rearranging and updating the treatment of radar systems analysis and design. It quickly became a bestseller and was widely adopted by many professors. The second edition built on this successful format by rearranging and updating the treatment of radar systems analysis and design.

Radar Signals Advances in digital signal processing algorithms and computer technology have combined to produce real-time systems with capabilities far beyond those of just a few years ago. Nonlinear, adaptive methods for signal processing have emerged to provide better array behavior, as well as the robustness of conventional algorithms. The challenge remains to develop a concept that exploits the advantages of both—a scheme that integrates these methods in practical, real-time systems. The Advanced Signal Processing Handbook helps you meet that challenge. Beyond offering an outstanding introduction to the principles and applications of advanced signal processing, it develops a generic processing structure that takes advantage of the similarities that exist among radar, sonar, and medical imaging systems and integrates conventional and nonlinear processing schemes.

Modulation, Resolution and Signal Processing in Radar, Sonar and Related Systems A text and general reference on the design and analysis of radar signals As radar technology evolves to
encompass a growing spectrum of applications in military, aerospace, automotive, and other sectors, innovations in digital signal processing have risen to meet the demand. Presenting a long overdue, up-to-date, dedicated resource on radar signals, the authors fill a critical gap in radar technology literature. Radar Signals features in-depth coverage of the most prevalent classical and modern radar signals used today, as well as new signal concepts developed in recent years. Inclusion of key MATLAB software codes throughout the book demonstrates how they dramatically simplify the process of describing and analyzing complex signals. Topics covered include: * Matched filter and ambiguity function concepts * Basic radar signals, with both analytical and numerical analysis * Frequency modulated and phase-coded pulses * Complete discussion of band-limiting schemes * Coherent LFM pulse trains-the most popular radar signal * Diversity in pulse trains, including stepped frequency pulses * Continuous-wave signals * Multicarrier phase-coded signals Combining lucid explanation, preferred signal tables, MATLAB codes, and problem sets in each chapter, Radar Signals is an essential reference for professionals-and a systematic tutorial for any seeking to broaden their knowledge base in this dynamic field.

MIMO Radar Signal Processing

Signal Processing Algorithms for Communication and Radar Systems Time-Frequency Signal Analysis and Processing (TFSAP) is a collection of theory, techniques and algorithms used for the analysis and processing of non-stationary signals, as found in a wide range of applications including telecommunications, radar, and biomedical engineering. This book gives the university researcher and R&D engineer insights into how to use TFSAP methods to develop and implement the engineering application systems they require. New to this edition: New sections on Efficient and Fast Algorithms; a "Getting Started" chapter enabling readers to start using the algorithms on simulated and real examples with the TFSAP toolbox, compare the results with the ones presented in the book and then insert the algorithms in their own applications and adapt them as needed. Two new chapters and twenty three new sections, including updated references. New topics including: efficient algorithms for optimal TFIs (with source code), the enhanced spectrogram, time-frequency modelling, more mathematical foundations, the relationships between QTFTs and Wavelet Transforms, new advanced applications such as cognitive radio, watermarking, noise reduction in the time-frequency domain, algorithms for Time-Frequency Image Processing, and Time-Frequency applications in neuroscience (new chapter). A comprehensive tutorial introduction to Time-Frequency Signal Analysis and Processing (TFSAP), accessible to anyone who has taken a first course in signals Key advances in theory, methodology and algorithms, are concisely presented by some of the leading authorities on the respective topics Applications written by leading researchers showing how to use TFSAP methods.

Signal Processing of Airborne Radar Stations Fourier transforms are used widely, and are of particular value in the analysis of single functions and combinations of functions found in radar and signal processing. Still, many problems that could have been tackled by using Fourier transforms may have gone unsolved because they require integration that is difficult and tedious. This newly revised and expanded edition of a classic Artech House book provides you with an up-to-date, coordinated system for performing Fourier transforms on a wide variety of functions. Along numerous updates throughout the book, the Second Edition includes a critical new chapter on periodic waveforms a topic not covered in any other book and detailed coverage of asymmetric triangular pulse. By building upon Woodward's well known "Rules and Pairs" method and related concepts and procedures, this book establishes a unified system that makes implicit the integration required for performing Fourier transforms on a wide variety of functions. It details how complex functions can be broken down to their constituent parts for analysis. You can now concentrate on functional relationships instead of getting bogged down in the details of integration. This approach to implementing Fourier transforms is illustrated with many specific examples from digital signal processing as well as radar and antenna operation. DVD-ROM Included! Contains MATLAB programs that implement many of the results presented in the book.

MATLAB Simulations for Radar Systems Design This second volume, edited and authored by world leading experts, gives a review of the principles, methods and techniques of important and emerging research topics in communications and radar engineering. With this reference source you will: Quickly grasp a new area of research Understand the underlying principles of a topic and its application Ascertain how a topic relates to other areas and learn of the research issues yet to be resolved Quick tutorial reviews of important and emerging topics of research in array and statistical signal processing Presents core principles and shows their application Reference content on core principles, technologies, algorithms and applications Comprehensive references to journal articles and other literature on which to build further, more specific and detailed knowledge Edited by leading people in the field who, through their reputation, have been able to commission experts to write on a particular topic.

Fourier Transforms in Radar and Signal Processing, Second Edition The report deals primarily with various doppler signal processing techniques for the Porcupine Weather Radar System. Continuing emphasis is placed on digital data reduction techniques including the fast Fourier transform method of spectral analysis. Practical methods of handling the vast amounts of data gathered by the Coherent Memory filter are discussed. Initial work on the computer analysis of the Velocity Azimuth Display including program documentation is also included. (Author).

Recent Advancements in Airborne Radar Signal Processing: Emerging Research and Opportunities This resource introduces a new image formation algorithm based on time-frequency-
transforms, showing its advantage over the more conventional Fourier-based image formation. Referenced with over 170 equations and 80 illustrations, the book presents new algorithms that help improve the result of radar imaging and signal processing.

Signal Processing for Passive Bistatic Radar This highly-anticipated second edition of an Artech House classic covers several key radar analysis areas: the radar range equation, detection theory, ambiguity functions, waveforms, antennas, active arrays, receivers and signal processors, CFAR and chaff analysis. Readers will be able to predict the detection performance of a radar system using the radar range equation, various parameters, matched filter theory, and Swerling target models. The performance of various signal processors, single pulse, pulsed Doppler, LFM, NLFM, and BPSK, are discussed, taking into account factors including MTI processing, integration gain, weighting loss and straddling loss. The details of radar analysis are covered from a mathematical perspective, with in-depth breakdowns of radar performance in the presence of clutter. Readers will be able to determine the nose temperature of a multi-channel receiver as it is used in active arrays. With the addition of three new chapters on moving target detectors, inverse synthetic aperture radar (ISAR) and constant false alarm rate (CFAR) and new MATLAB codes, this expanded second edition will appeal to the novice as well as the experienced practitioner.

Principles of Radar and Sonar Signal Processing Synthetic Aperture Radar Processing simply and methodically presents principles and techniques of Synthetic Aperture Radar (SAR) image generation by analyzing its system transfer function. The text considers the full array of operation modes from strip to scan, emphasizes processing techniques, enabling the design of operational SAR codes. A simple example then follows. This book will be invaluable to all SAR scientists and engineers working in the field. It may be used as the basis for a course on SAR image generation or as a reference book on remote sensing. It contains a wide spectrum of information presented with clarity and rigor.

Synthetic Aperture Radar Processing Simulation is integral to the successful design of modern radar systems, and there is arguably no better software for this purpose than MATLAB. But software and the ability to use it does not guarantee success. One must also: Understand radar operations and design philosophy Know how to select the radar parameters to meet the design req

Knowledge Based Radar Detection, Tracking and Classification This cutting-edge resource introduces the basic concepts of passive bistatic radar, such as bistatic geometry, bistatic radar equation and analysis of different illuminating signals. These techniques, although known for almost a century, have not been developed intensively for decades, mainly due to technical limitations, but today, the passive radar concept can be realized in practice, and is of great interest for military and civilian users. This book provides insight into understanding the potential and limitations of passive radar systems, as well as the differences between signal processing in active and passive radar. Each of the signal processing stages typically applied in passive radar is described, including digital beamforming, clutter removal, target detection, localization and tracking. These concepts are illustrated with both simulated and measured data along with examples of passive radar systems. Correlation processing, which is crucial for passive radar operation, is presented, as well as practical approaches for calculating the cross-ambiguity function. The problems of range and velocity-cell migration are also introduced. The book analyzes and compares different antenna array geometries to show readers the appropriate solution for a particular scenario of passive radar. Cartesian tracking is also presented, based on the extended Kalman filter. Parallel and sequential updating approaches are introduced and compared. These concepts are illustrated with both simulated and measured data along with examples of passive radar systems, making this book useful for both novice and advanced practitioners.

Time-Frequency Signal Analysis and Processing The 2nd Edition of this popular textbook is a major revision. It is written within the context of communication theory as well as the theory of signals and noise. Part I bridges the gap between communication theory, signals and noise and radar system analysis. Part II is on radar subsystems and associated topics and includes most common radar signal processing techniques, the theory of radar detection, coherent and non-coherent integration, and radar clutter analysis. Part III of this Edition will analyze special topics in radar systems. Many new exercises are included and the author provides comprehensive easy to follow mathematical derivations of all key equations and formulas.
Synthetic Aperture Radar Signal Processing with MATLAB Algorithms

Radar Signals: An Introduction to Theory and Application introduces the reader to the basic theory and application of radar signals that are designated as large time-bandwidth or pulse-compression waveforms. Topics covered include matched filtering and pulse compression; optimum predetection processing; the radar ambiguity function; and the linear frequency modulation waveform and matched filter. Parameter estimation and discrete coded waveforms are also discussed, along with the effects of distortion on matched-filter signals. This book is comprised of 14 chapters and begins with an overview of the concepts and techniques of pulse compression matched filtering, with emphasis on coding source and decoding device. The discussion then turns to the derivation of the matched-filter properties in order to maximize the signal-to-noise ratio; analysis of radar ambiguity function using the principle of stationary phase; parameter estimation and the method of maximum likelihood; and measurement accuracies of matched-filter radar signals. Waveform design criteria for multiple and dense target environments are also considered. The final chapter describes a number of techniques for designing microwave dispersive delays. This monograph will be a useful resource for graduate students and practicing engineers in the field of radar system engineering.

Digital Signal Processing Techniques and Applications in Radar Image Processing

Discover the technology for the next generation of radar systems. Here is the first book that brings together the key concepts essential for the application of Knowledge Based Systems (KBS) to radar detection, tracking, classification, and scheduling. The book highlights the latest advances in both KBS and radar signal and data processing, presenting a range of perspectives and innovative results that have set the stage for the next generation of adaptive radar systems. The book begins with a chapter introducing the concept of Knowledge Based (KB) radar. The remaining nine chapters focus on current developments and recent applications of KB concepts to specific radar functions. Among the key topics explored are: Fundamentals of relevant KB techniques KB solutions as they apply to the general radar problem KBS applications for the constant false-alarm rate processor KB control for space-time adaptive processing KB techniques applied to existing radar systems Integrated end-to-end radar signals Data processing with overarching KB control All chapters are self-contained, enabling readers to focus on those topics of greatest interest. Each one begins with introductory remarks, moves on to detailed discussions and analysis, and ends with a list of references. Throughout the presentation, the authors offer examples of how KBS works and how it can dramatically improve radar performance and capability. Moreover, the authors forecast the impact of KB technology on future systems, including important civilian, military, and homeland defense applications. With chapters contributed by leading international researchers and pioneers in the field, this text is recommended for both students and professionals in radar and sonar detection, tracking, and classification and radar resource management.

Doppler Signal Analysis and Processing Techniques for Modified ‘porcupine’ C-band Pulse Doppler Radar

Now available in a three-volume set, this updated and expanded edition of the bestselling The Digital Signal Processing Handbook continues to provide the engineering community with authoritative coverage of the fundamental and specialized aspects of information-bearing signals in digital form. Encompassing essential background material, technical details, standards, and software, the second edition reflects cutting-edge information on signal processing algorithms and protocols related to speech, audio, multimedia, and video processing technology associated with standards ranging from WiMax to MP 3 audio, low-power/high-performance DSPs, color image processing, and chips on video. Drawing on the experience of leading engineers, researchers, and scholars, the three-volume set contains 29 new chapters that address multimedia and Internet technologies, tomography, radar systems, architecture, standards, and future applications in speech, acoustics, video, radar, and telecommunications. This volume, Wireless, Networking, Radar, Sensor Array Processing, and Nonlinear Signal Processing, provides complete coverage of the foundations of signal processing related to wireless, radar, space-time coding, and mobile communications, together with associated applications to networking, storage, and communications.

Topics in Radar Signal Processing: Radar Signal Processing and Its Applications brings together in one place important contributions and up-to-date research results in this fast-moving area. In twelve selected chapters, it describes the latest advances in architectures, design methods, and applications of radar signal processing. The contributors to this work were selected from the leading researchers and practitioners in the field. This work, originally published as Volume 14, Numbers 1-3 of the journal, Multidimensional Systems and Signal Processing, will be valuable to anyone working or researching in the field of radar signal processing. It serves as an excellent reference, providing insight into some of the most challenging issues being examined today.

Digital Signal Processing 101

This collaborative work presents the results of over twenty years of pioneering research by Professor Simon Haykin and his colleagues, dealing with the use of adaptive radar signal processing to account for the nonstationary nature of the environment. These results have profound implications for defense-related signal processing and remote sensing. References are provided in each chapter guiding the reader to the original research on which this book is based.

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