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Finally, a summary and conclusion is providedAuthors: Nguyen, Cam, Park, Joongsuk This book presents the theory, analysis and design of microwave stepped-frequency radar sensors. Stepped-frequency radar sensors are attractive for various sensing applications that require fine resolution. The book consists of five chapters.

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Stepped-Frequency Radar Sensors : Theory, Analysis and Design, Paperback by Nguyen, Cam; Park, Joongsuk, ISBN 3319122703, ISBN-13 9783319122700, Like New Used, Free shipping This book presents the theory, analysis and design of microwave stepped-frequency radar sensors.

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Wideband distributed coherent aperture radar based on stepped frequency signal: theory and experimental results. Author(s): Tao Zeng; Pilei Yin; Quanhua Liu
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The Spectrally Agile Frequency-Incrementing Reconfigurable radar is a vehicle-mounted, forward-looking ground-penetrating radar system designed to detect buried or hidden explosive hazards. It was developed by the U.S. Army Research Laboratory in 2016 as part of a long generation of ultra-wideband and synthetic aperture radar systems created to combat buried landmines and IEDs. Past iterations include the railSAR, the boomSAR, and the SIRE radar.

This book presents the theory, analysis and design of microwave stepped-frequency radar sensors. Stepped-frequency radar sensors are attractive for various sensing applications that require fine resolution. The book consists of five chapters. The first chapter describes the fundamentals of radar sensors including applications followed by a review of ultra-wideband pulsed, frequency-modulated continuous-wave (FMCW), and stepped-frequency radar sensors. The second chapter discusses a general analysis of radar sensors including wave propagation in media and scattering on targets, as well as the radar equation. The third chapter addresses the analysis of stepped-frequency radar sensors including their principles and design parameters. Chapter 4 presents the development of two stepped-frequency radar sensors at microwave and millimeter-wave frequencies based on microwave integrated circuits (MICs), microwave monolithic integrated circuits (MMICs) and printed-circuit antennas, and discusses their signal processing. Chapter 5 provides the electrical characterization and test results of the developed microwave and millimeter-wave stepped-frequency radar sensors. Finally, a summary and conclusion is provided.

In this dissertation, we have studied totally eight topics which are focused on but not limited to radar sensor networks (RSN) from a signal processing perspective. We propose the definitions of ZCZ/LCZ (Zero Correlation Zone/Low Correlation Zone) sequence-pair sets, provided three methods to construct optimized optimized punctured LCZ/ZCZ sequence-pair sets and study their properties in chapter 2 and 3. We further investigate the waveform design problem for radar system, radar sensor network, sonar sensor network and MIMO radar system from chapter 4 to chapter 7. In addition, we study radar sensor network from the view of information theory in chapter 8. We also study compressive sensing and apply it to RSN to further investigate the system performance in chapter 9 and chapter 10. In chapter 11, we briefly conclude our work in this dissertation. The main innovation works of this dissertation are as following. We propose the LCZ/ZCZ Sequence-pair Sets that have ideal autocorrelation sidelobes and cross correlation values during LCZ/ZCZ. We also provide three methods to construct the Optimized Punctured LCZ/ZCZ Sequence-pair Sets which is a specific case of the LCZ/ZCZ Sequence-pair Sets. We not only theoretically prove that the sequence-pair sets constructed by our methods satisfy the definitions of the Optimized Punctured LCZ/ZCZ Sequence-pair sets, but also provide examples for

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each method and analyze properties of the Optimized Punctured LCZ/ZCZ Sequence-pair sets to help further investigating our proposed codes. The main purpose of pulse compression is to raise the signal to maximum sidelobe (signal-to-sidelobe) ratio to improve the target detection and range resolution abilities of the system. We apply the Optimized Punctured Binary Sequence-pair to the Radar system as the phase coded waveforms which is a kind of pulse compression codes. Comparing with the Barker and P4 codes of corresponding length, the Radar system within the Optimized Punctured Binary Sequence-pair could clearly improve the detection performances. Since multiple radar sensors can be combined to form a multi radar system to overcome performance degradation of single radar along with waveform optimization, we theoretically study RSN design using phase coded waveforms. We apply our newly proposed codes to RSN and analyze the detection performance of the system. We also apply the proposed ternary codes to the Sonar Sensor Network (SSN) as pulse compression codes for narrowband pulse signals and simulate the target detection performance of the system. We provide two MIMO radar systems using our proposed codes as orthogonal pulse compression codes to study the direction finding performance of the MIMO radar systems. We theoretically analyze the two MIMO radar system models and simulate the direction finding performance of the system. We also studied the RSN from the view of information theory. We investigate the use of information theory to design waveforms for the measurement of extended radar targets in RSN. We optimized the estimation waveforms that maximize the mutual information between a target ensemble and the received signal within additive Gaussian noise so that characteristics of the target could be well recognized. Finally, we provide and analyze a CS-SVD method to simplify the signal recovery algorithm and introduce CS to RSN using pulse compression technique. Our idea is to employ a set of Stepped-Frequency (SF) waveforms as pulse compression codes for transmit sensors, and to use the same SF waveforms as the sparse matrix to compress the signal in the receiving sensor. We obtain that the signal samples along the time domain could be largely compressed so that they could be perfectly recovered by a small number of measurements. We develop a Maximum Likelihood (ML) Algorithm for Radar Cross Section (RCS) parameter estimation and provide the Cramer-Rao lower bound (CRLB) to validate the theoretical result.

Radar Expert, Esteemed Author Gregory L. Charvat on CNN and CBS Author Gregory L. Charvat appeared on CNN on March 17, 2014 to discuss whether Malaysia Airlines Flight 370 might have literally flown below the radar. He appeared again on CNN on March 20, 2014 to explain the basics of radar, and he explored the hope and limitations of the technology involved in the search for Flight 370 on CBS on March 22, 2014. Get His Book Now Coupling theory with reality, from derivation to implementation of actual radar systems, Small and Short-Range Radar Systems analyzes and then provides design procedures and working design examples of small and short-range radar systems. Discussing applications from automotive to through-wall imaging, autonomous vehicle, and beyond, the practical text supplies high-level descriptions, theoretical derivations, back-of-envelope calculations, explanations of processing algorithms, and case studies for each type of small radar system covered, including continuous wave (CW), ultrawideband (UWB) impulse, linear frequency modulation (FM), linear rail synthetic aperture radar (SAR), and phased array. This essential reference: Explains how to design your own radar devices Demonstrates how to process data from small radar sensors Provides real-world, measured radar data to test algorithms before investing development time Complete with downloadable MATLAB® scripts and actual radar measurements, Small and Short-Range Radar Systems empowers you to rapidly develop small radar technology for your application.

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,

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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.

This book deals with the basic theory for design and analysis of Low Probability of Intercept (LPI) radar systems. The design of one such multi-frequency high resolution LPI radar, PANDORA, is covered. This work represents the first time that the topic of multi-frequency radars is discussed in such detail and it is based on research conducted by the author in The Netherlands. The book provides the design tools needed for development, design, and analysis of high resolution radar systems for commercial as well as military applications. Software written in MATLAB and C++ is provided to guide the reader in calculating radar parameters and in ambiguity function analysis. Some radar simulation software is also included.

Every day, civilians in dozens of countries around the world are injured and killed by landmines and other lethal leftovers of conflict, years after hostilities of war have ended. Once planted, a mine will never be able to tell the difference between a military and civilian footstep, and a bomblet will continue to attract children and metal dealers. In order to put an end to the suffering and casualties caused by antipersonnel mines, the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (the Ottawa Convention or Mine Ban Treaty), was adopted in 1997. Further, in order to prevent suffering and casualties caused by cluster munitions at the time of their use, the Convention on the Use, Stockpiling, Production and Transfer of Cluster Munitions (the Oslo Convention), was adopted in 2008. In 1996, the Royal Military Academy (RMA) opted for the implementation of mine action technological projects funded by the Belgian Ministry of Defense and the Belgian State Secretariat for Development Cooperation. It further decided to set up a close collaboration with other Belgian universities, which started organizing their own research activities on mine action. Later, other funding sources were granted to RMA by the Belgian Science Policy, the European Commission, and the European Committee for Standardization. At a more politico-administrative level, RMA participates in the States Parties Meetings of the Mine Ban Treaty, and in this context, Prof. Acheroy created an expert group on mine action technologies with representatives of different organizations and countries, aiming at informing the States Parties of the Mine Ban Treaty about the evolution of the mine action technologies. Further, Prof. Y. Baudoin created working groups dedicated to robotics in mine action within international organization. This book reports research activities achieved by the RMA.s

Enhances your understanding of the concepts and design techniques for high-resolution radar systems.

Ground-penetrating radar (GPR) is a rapidly developing field that has seen tremendous progress over the past 15 years. The development of GPR spans aspects of geophysical science, technology, and a wide range of scientific and engineering applications. It is the breadth of applications that has made GPR such a valuable tool in the geophysical consulting and geotechnical engineering industries, has led to its rapid development, and inspired new areas of research in academia. The topic of GPR has gone from not even being mentioned in geophysical texts ten years ago to being the focus of hundreds of research papers and special issues of journals dedicated to the topic. The explosion of primary literature devoted to GPR technology, theory and applications, has led to a strong demand for an up-to-

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date synthesis and overview of this rapidly developing field. Because there are specifics in the utilization of GPR for different applications, a review of the current state of development of the applications along with the fundamental theory is required. This book will provide sufficient detail to allow both practitioners and newcomers to the area of GPR to use it as a handbook and primary research reference. *Review of GPR theory and applications by leaders in the field *Up-to-date information and references *Effective handbook and primary research reference for both experienced practitioners and newcomers

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

Through-the-wall radar imaging (TWRI) allows police, fire and rescue personnel, first responders, and defense forces to detect, identify, classify, and track the whereabouts of humans and moving objects. Electromagnetic waves are considered the most effective at achieving this objective, yet advances in this multi-faceted and multi-disciplinary technology require taking phenomenological issues into consideration and must be based on a solid understanding of the intricacies of EM wave interactions with interior and exterior objects and structures. Providing a broad overview of the myriad factors involved, namely size, weight, mobility, acquisition time, aperture distribution, power, bandwidth, standoff distance, and, most importantly, reliable performance and delivery of accurate information, Through-the-Wall Radar Imaging examines this technology from the algorithmic, modeling, experimentation, and system design perspectives. It begins with coverage of the electromagnetic properties of walls and building materials, and discusses techniques in the design of antenna elements and array configurations, beamforming concepts and issues, and the use of antenna array with collocated and distributed apertures. Detailed chapters discuss several suitable waveforms inverse scattering approaches and revolve around the relevance of physical-based model approaches in TWRI along with theoretical and experimental research in 3D building tomography using microwave remote sensing, high-frequency asymptotic modeling methods, synthetic aperture radar (SAR) techniques, impulse radars, airborne radar imaging of multi-floor buildings strategies for target detection, and detection of concealed targets. The book concludes with a discussion of how the Doppler principle can be used to measure motion at a very fine level of detail. The book provides a deep understanding of the challenges of TWRI, stressing its multidisciplinary and phenomenological nature. The breadth and depth of topics covered presents a highly detailed treatment of this potentially life-saving technology.

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