

Spotlight Mode Synthetic Aperture Radar A Signal Processing Approach

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 Synthetic Aperture Radar Systems
 Encyclopedia of Optical Engineering: Pho-Z, pages 2049-3050
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CARMELO LANE

Spaceborne Synthetic Aperture Radar KIT Scientific Publishing

Synthetic aperture radar (SAR) is a well-known remote sensing technique, but conventional single-antenna SAR is inherently limited by the minimum antenna area constraint. Although there are still technical issues to overcome, multi-antenna SAR offers many benefits, from improved system gain to increased degrees-of-freedom and system flexibility. Multi-Antenna Synthetic Aperture Radar explores the potential and challenges of using multi-antenna SAR in microwave remote sensing applications. These applications include high-resolution imaging, wide-swath remote sensing, ground moving target indication, and 3-D imaging. The book pays particular attention to the signal processing aspects of various multi-antenna SAR from a top-level system perspective. Explore Recent Extensions of Synthetic Aperture Radar Systems The backbone of the book is a series of innovative microwave remote sensing approaches developed by the author. Centered around multi-antenna SAR imaging, these approaches address specific challenges and potential problems in future microwave remote sensing. Chapters examine single-input multiple-output (SIMO) multi-antenna SAR, including azimuth and elevation multi-antenna SAR, and multiple-input multiple-output (MIMO) SAR. The book details the corresponding system scheme, signal models, time/phase/spatial synchronization methods, and high-precision imaging algorithms. It also investigates their potential applications. Introductory Tutorials and Novel Approaches in Multi-Antenna SAR Imaging Rigorous and self-contained, this is a unique reference for researchers and industry professionals working with microwave remote sensing, SAR imaging, and radar signal processing. In addition to novel approaches, the book also presents tutorials that serve as an introduction to multi-antenna SAR imaging for those who are new to the field.

Principles of Synthetic Aperture Radar Imaging Springer Nature

Modern airborne and spaceborne imaging radars, known as synthetic aperture radars (SARs), are capable of producing high-quality pictures of the earth's surface while avoiding some of the shortcomings of certain other forms of remote imaging systems. Primarily, radar overcomes the nighttime limitations of optical cameras, and the cloud-cover limitations of both optical and infrared imagers. In addition, because imaging radars use a form of coherent illumination, they can be used in certain special modes such as interferometry, to produce some unique derivative image products that incoherent systems cannot. One such product is a highly accurate digital terrain elevation map (DTEM). The most recent (ca. 1980) version of imaging radar, known as spotlight-mode SAR, can produce imagery with spatial resolution that begins to approach that of remote optical imagers. For all of these reasons, synthetic aperture radar imaging is rapidly becoming a key technology in the world of modern remote sensing. Much of the basic 'workings' of synthetic aperture radars is rooted in the concepts of signal processing. Starting with that premise, this book explores in depth the fundamental principles upon which the spotlight mode of SAR imaging is constructed, using almost exclusively the language, concepts, and major building blocks of signal processing. Spotlight-Mode Synthetic Aperture Radar: A Signal Processing Approach is intended for a variety of audiences. Engineers and scientists working in the field of remote sensing but who do not have experience with SAR imaging will find an easy entrance into what can seem at times a very complicated subject. Experienced radar engineers will find that the book describes several modern areas of SAR processing that they might not have explored previously, e.g. interferometric SAR for change detection and terrain elevation mapping, or modern non-parametric approaches to SAR autofocus. Senior undergraduates (primarily in electrical engineering) who have had courses in digital signal and image processing, but who have had no exposure to SAR could find the book useful in a one-semester course as a reference.

Synthetic Aperture Radar Systems CRC Press

Explore the principles and applications of synthetic aperture radar This comprehensive guide offers a solid grounding in synthetic aperture radar (SAR) fundamentals and techniques. Written by a remote sensing and signal processing expert, *Introduction to Synthetic Aperture Radar: Concepts and Practice* clearly explains data collection, image formation, error correction, and image quality. You will get concise descriptions of commonly used image formation algorithms, including the Range-Doppler Algorithm (RDA) and the Polar Formatting Algorithm (PFA). Continuous wave LFM systems, interferometry, polarimetry, and moving objects are discussed in detail. Coverage includes: Origins of synthetic aperture radar Ranging and imaging Image formation and image processing tools Linear frequency-modulated chirp Image formation algorithms for quadrature demodulated data Image formation algorithms for dechirped data Autofocus Image quality and speckle reduction Linear frequency-modulated continuous wave systems Remote sensing Interferometry Moving objects in SAR

Encyclopedia of Optical Engineering: Pho-Z, pages 2049-3050 Springer

This comprehensive introduction to synthetic aperture radar (SAR) is a practical guide to the analysis, simulation, and design of SAR systems. The video eBook uses constructive examples and real-world collected datasets to demonstrate image registration and autofocus methods. Both two- and three-dimensional image formation algorithms are presented. Hardware, software, and environmental parameters are used to estimate performance limits for SAR operation and utilization. A set of Python and MATLAB software tools is included and provides you with an effective mechanism to analyze and predict SAR performance for various imaging scenarios and applications. Examples which use the software tools are provided at the end of each chapter to reinforce critical SAR imaging topics such as clutter-to-noise ratio, mapping rate, spatial resolution, Doppler bandwidth, pulse repetition frequency, and coherency. This is an excellent resource for engineering professionals working in areas of radar signal processing and imaging as well as students interested in studying SAR.

Encyclopedia of Optical and Photonic Engineering (Print) - Five Volume Set CRC Press

Spotlight-Mode Synthetic Aperture Radar: A Signal Processing Approach Springer Science & Business Media

Imaging with Synthetic Aperture Radar Artech House

An authoritative work on Synthetic Aperture Radar system engineering, with key focus on high resolution imaging, moving target indication, and system engineering technology Synthetic Aperture Radar (SAR) is a powerful microwave remote sensing technique that is used to create high resolution two or three-dimensional representations of objects, such as landscapes, independent of weather conditions and sunlight illumination. SAR technology is a multidisciplinary field that involves microwave technology, antenna technology, signal processing, and image information processing. The use of SAR technology continues grow at a rapid pace in a variety of applications such as high-resolution wide-swath observation, multi-azimuth information acquisition, high-temporal information acquisition, 3-D terrain mapping, and image quality improvement. Design Technology of Synthetic Aperture Radar provides detailed coverage of the fundamental concepts, theories, technology, and design of SAR systems and sub-systems. Supported by the author's over two decades of research and practice experience in the field, this in-depth volume systematically describes SAR design and presents the latest research developments. Providing examination of all topics relevant to SAR—from radar and antenna system design to receiver technology and signal and image information processing—this comprehensive resource: Provides wide-ranging, up-to-date examination of all major topics related to SAR science, systems, and software Includes guidelines to conduct grounding system designs and analysis Offers coverage of all SAR algorithm classes and detailed SAR algorithms suitable for enabling software implementations Surveys SAR and computed imaging literature of the last sixty years Emphasizes high resolution imaging, moving target

indication, and system engineering Design Technology of Synthetic Aperture Radar is indispensable for graduate students majoring in SAR system design, microwave antenna, signal and information processing as well as engineers and technicians involved in SAR system techniques.

CRC Press

This book comprehensively describes high-resolution microwave imaging and super-resolution information processing technologies and discusses new theories, methods and achievements in the high-resolution microwave imaging fields. Its chapters, which include abundant research results and examples, systematically summarize the authors' main research findings in recent years. The book is intended for researchers, engineers and postgraduates in the fields of electronics systems, signal information processing and data analysis, microwave remote sensing and microwave imaging radar, as well as space technology, especially in the microwave remote sensing and airborne or space-borne microwave imaging radar fields.

[Introduction to Synthetic Aperture Radar Using Python and MATLAB®](#) John Wiley & Sons

Principles of Synthetic Aperture Radar Imaging: A System Simulation Approach demonstrates the use of image simulation for SAR. It covers the various applications of SAR (including feature extraction, target classification, and change detection), provides a complete understanding of SAR principles, and illustrates the complete chain of a SAR operation.

[International Encyclopedia of Geography, 15 Volume Set](#) John Wiley & Sons

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.

[Spotlight-Mode Synthetic Aperture Radar: A Signal Processing Approach](#) CRC Press

Build your knowledge of SAR/ISAR imaging with this comprehensive and insightful resource. The newly revised Second Edition of Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms covers in greater detail the fundamental and advanced topics necessary for a complete understanding of inverse synthetic aperture radar (ISAR) imaging and its concepts. Distinguished author and academician, Caner Özdemir, describes the practical aspects of ISAR imaging and presents illustrative examples of the radar signal processing algorithms used for ISAR imaging. The topics in each chapter are supplemented with MATLAB codes to assist readers in better understanding each of the principles discussed within the book. This new edition includes discussions of the most up-to-date topics to arise in the field of ISAR imaging and ISAR hardware design. The book provides a comprehensive analysis of advanced techniques like Fourier-based radar imaging algorithms, and motion compensation techniques along with radar fundamentals for readers new to the subject. The author covers a wide variety of topics, including: Radar fundamentals, including concepts like radar cross section, maximum detectable range, frequency modulated continuous wave, and doppler frequency and pulsed radar. The theoretical and practical aspects of signal processing algorithms used in ISAR imaging. The numeric implementation of all necessary algorithms in MATLAB. ISAR hardware, emerging topics on SAR/ISAR focusing algorithms such as bistatic ISAR imaging, polarimetric ISAR imaging, and near-field ISAR imaging. Applications of SAR/ISAR imaging techniques to other radar imaging problems such as thru-the-wall radar imaging and ground-penetrating radar imaging. Perfect for graduate students in the fields of electrical and electronics engineering, electromagnetism, imaging radar, and physics. Inverse Synthetic Aperture Radar Imaging With MATLAB Algorithms also belongs on the bookshelves of practicing researchers in the related areas looking for a useful resource to assist them in their day-to-day professional work.

[Highly Resolved Synthetic Aperture Radar With Beam Steering](#) MDPI

The present work deals with a highly resolved radar with a synthetic aperture (synthetic aperture radar - SAR), which uses a beam steering to improve performance. The first part of this work deals with the influence of various effects occurring in the hardware of the High-Resolution Wide-Swath SAR (HRWS SAR) system. A special focus was set to single bit quantization in multi-channel receiver. The second part of this work describes SAR processors for Sliding Spotlight mode. This work was published by Saint Philip Street Press pursuant to a Creative Commons license permitting commercial use. All rights not granted by the work's license are retained by the author or authors.

[Inverse Synthetic Aperture Radar Imaging With MATLAB Algorithms](#) Artech House

Bistatic Synthetic Aperture Radar covers bistatic SAR in a comprehensive way, presenting theory, method and techniques, as well as the most recent research and near-future applications. The book begins with imaging principles and characteristics of monostatic SAR, moving on to common and novel problems before presenting theories, methods and experimental system design. The title presents the design of experimental systems, research results and experimental verification. It gives key knowledge from a leading research group, including one of the earliest bistatic side-looking SAR experiments and the first bistatic forward-looking SAR experiment in the world that used two aircraft. Six chapters cover imaging theory, imaging algorithms, parameter estimation, motion compensation, synchronization and experimental verification. The book describes physical concepts simply and clearly and provides concise mathematical derivations. Presents comprehensive theory and methods for bistatic SAR, including the design of experimental systems and verification. Considers different configurations, including translational variant bistatic SAR and bistatic forward-looking SAR. Gives insights based on a world-leading research program into bistatic SAR, including practical tips on theory and method. Covers novel experiments, including the first bistatic forward-looking SAR experiment using two aircraft. Offers researchers clear descriptions of physical concepts and concise mathematical derivations to help master bistatic SAR.

[Meter-Wave Synthetic Aperture Radar for Concealed Object Detection](#) Springer

This Special Issue is a collection of papers addressing the scientific use of data acquired in the course of the TerraSAR-X mission 10 years after launch. The articles deal with the mission itself, the accuracy of the products, with differential interferometry, and with applications in the domains cryosphere, oceans, wetlands, and urban areas.

[Design Technology of Synthetic Aperture Radar](#) John Wiley & Sons

This book provides a full representation of Inverse Synthetic Aperture Radar (ISAR) imagery, which is a popular and important radar signal processing tool. The book covers all possible aspects of ISAR imaging. The book offers a fair amount of signal processing techniques and radar basics before introducing the inverse problem of ISAR and the forward problem of Synthetic Aperture Radar (SAR). Important concepts of SAR such as resolution, pulse compression and image formation are given together with associated MATLAB codes. After providing the fundamentals for ISAR imaging, the book gives the detailed imaging procedures for ISAR imaging with associated MATLAB functions and

codes. To enhance the image quality in ISAR imaging, several imaging tricks and fine-tuning procedures such as zero-padding and windowing are also presented. Finally, various real applications of ISAR imagery, like imaging the antenna-platform scattering, are given in a separate chapter. For all these algorithms, MATLAB codes and figures are included. The final chapter considers advanced concepts and trends in ISAR imaging.

[Synthetic Aperture Radar](#) Artech House Publishers

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.

[Spotlight Synthetic Aperture Radar](#) CRC Press

Synthetic aperture radar provides broad-area imaging at high resolutions, which is used in applications such as environmental monitoring, earth-resource mapping, and military systems. This book presents the tools required for the digital processing of synthetic aperture radar images. They are of three types: (a) the elements of physics, (b) mathematical models and (c) image processing methods adapted to particular applications.

[Synthetic Aperture Radar](#) Elsevier

Compiled by 330 of the most widely respected names in the electro-optical sciences, the Encyclopedia is destined to serve as the premiere guide in the field with nearly 2000 figures, 560 photographs, 260 tables, and 3800 equations. From astronomy to x-ray optics, this reference contains more than 230 vivid entries examining the most intriguing technological advances and perspectives from distinguished professionals around the globe. The contributors have selected topics of utmost importance in areas including digital image enhancement, biological modeling, biomedical spectroscopy, and ocean optics, providing thorough coverage of recent applications in this continually expanding field.

[Synthetic Aperture Radar Processing](#) John Wiley & Sons

The first edition of the Encyclopedia of Optical and Photonic Engineering provided a valuable reference concerning devices or systems that generate, transmit, measure, or detect light, and to a lesser degree, the basic interaction of light and matter. This Second Edition not only reflects the changes in optical and photonic engineering that have occurred since the first edition was published, but also: Boasts a wealth of new material, expanding the encyclopedia's length by 25 percent. Contains extensive updates, with significant revisions made throughout the text. Features contributions from engineers and scientists leading the fields of optics and photonics today. With the addition of a second editor, the Encyclopedia of Optical and Photonic Engineering, Second Edition offers a balanced and up-to-date look at the fundamentals of a diverse portfolio of technologies and discoveries in areas ranging from x-ray optics to photon entanglement and beyond. This edition's release corresponds nicely with the United Nations General Assembly's declaration of 2015 as the International Year of Light, working in tandem to raise awareness about light's important role in the modern world. Also Available Online. This Taylor & Francis encyclopedia is also available through online subscription, offering a variety of extra benefits for researchers, students, and librarians, including: Citation tracking and alerts. Active reference linking. Saved searches and marked lists. HTML and PDF format options. Contact Taylor and Francis for more information or to inquire about subscription options and print/online combination packages. US: (Tel) 1.888.318.2367; (E-mail) e-reference@taylorandfrancis.com International: (Tel) +44 (0) 20 7017 6062; (E-mail) online.sales@tandf.co.uk

[Hurricane Monitoring With Spaceborne Synthetic Aperture Radar](#) John Wiley & Sons

An authoritative work on Synthetic Aperture Radar system engineering, with key focus on high resolution imaging, moving target indication, and system engineering technology. Synthetic Aperture Radar (SAR) is a powerful microwave remote sensing technique that is used to create high resolution two or three-dimensional representations of objects, such as landscapes, independent of weather conditions and sunlight illumination. SAR technology is a multidisciplinary field that involves microwave technology, antenna technology, signal processing, and image information processing. The use of SAR technology continues to grow at a rapid pace in a variety of applications such as high-resolution wide-swath observation, multi-azimuth information acquisition, high-temporal information acquisition, 3-D terrain mapping, and image quality improvement. Design Technology of Synthetic Aperture Radar provides detailed coverage of the fundamental concepts, theories, technology, and design of SAR systems and sub-systems. Supported by the author's over two decades of research and practice experience in the field, this in-depth volume systematically describes SAR design and presents the latest research developments. Providing examination of all topics relevant to SAR—from radar and antenna system design to receiver technology and signal and image information processing—this comprehensive resource: Provides wide-ranging, up-to-date examination of all major topics related to SAR science, systems, and software. Includes guidelines to conduct grounding system designs and analysis. Offers coverage of all SAR algorithm classes and detailed SAR algorithms suitable for enabling software implementations. Surveys SAR and computed imaging literature of the last sixty years. Emphasizes high resolution imaging, moving target indication, and system engineering. Design Technology of Synthetic Aperture Radar is indispensable for graduate students majoring in SAR system design, microwave antenna, signal and information processing as well as engineers and technicians involved in SAR system techniques.

[Multi-antenna Synthetic Aperture Radar](#) Margret Schneider

Based on the experiences of the Department of Information Engineering of the University of Pisa and the Radar and Surveillance System (RaSS) national laboratory of the National Interuniversity Consortium of Telecommunication (CNIT), Radar Imaging for Maritime Observation presents the most recent results in radar imaging for maritime observation. The book explores both the areas of sea surface remote sensing and maritime surveillance providing key theoretical concepts of SAR and ISAR imaging and more advanced and ad-hoc techniques for applications in maritime scenarios. The book is organized in two sections. The first section discusses the fundamentals of standard SAR/ISAR processing and novel imaging techniques, such as Bistatic, Passive, and 3D Interferometric ISAR. The second section focuses on the applications and results obtained by processing real data from maritime observations like SAR image processing for oil spill, detection in SAR images and fractal analysis. Useful to both beginners and experts in maritime observation, this book provides several examples of (mainly space-borne) radar imaging of maritime targets. Nevertheless, the same principles and techniques apply to the case of manned or unmanned carriers and to ground and air moving targets.

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