

An Introduction To Underwater Acoustics By Xavier Lurton

The comprehensive research activity around the World in the fields of Underwater Acoustics and Signal Processing being strongly supported by new experimental technique and equipment and by the parallel fast developments in computer technology and solid state devices, which has led to a rapidly reducing cost of digital processing thus enabling more complex processing to be carried out economically, emphasize how necessary it is at intervals of a few years through a NATO Advanced Study Institute (NATO ASI) and guided by leading experts to study the conquests in the fields of Underwater Acoustics and Signal Processing. This need of study is moreover stressed by the interdisciplinarity of Underwater Acoustics and Signal Processing, where a strong impact from other branches of science, - Geophysics, Radioastronomy, Bioengineering, Telecommunication, Seismology, Space Research etc. - is taking place, which makes it an extremely difficult task for scientists to follow-up the development in all its phases and to preserve the general view of its rapidly increasing number of possibilities. The present Proceedings of the NATO ASI held in Copenhagen during August 1980 join the series of proceedings of NATO summer schools on Underwater Acoustics and Signal Processing held during the past 20 years. The equality and the fusion of the individual research fields of Underwater Acoustics and Signal Processing and the separate introduction of advanced research results from other scientific areas related to underwater acoustics such as transducers characterize the subject matter of this NATO ASI.

An Introduction to Sonar Systems Engineering Second Edition Important topics that are fundamental to the understanding of modern-day sonar systems engineering are featured. Linear, planar, and volume array theory, including near-field and far-field beam patterns, beam steering, and array focusing, are covered. Real-world arrays such as the twin-line planar array and a linear array of triplets, which are solutions to the port/starboard (left/right) ambiguity problem associated with linear towed arrays, are examined in detail. Detailed explanations of the fundamentals of side-looking (side-scan) and synthetic-aperture sonars are presented. Bistatic scattering with moving platforms is explored with derivations of exact solutions for the time delay, time-compression/time-expansion factor, and Doppler shift at a receiver for both the scattered and direct acoustic paths. Time-domain and frequency-domain descriptions, and the design of CW, LFM, and Doppler-invariant HFM pulses, are explained. Target detection in the presence of reverberation and noise is examined. Time-domain and frequency-domain descriptions of MFSK, MQAM, and OFDM underwater acoustic communication signals are also discussed. Although the book is mathematically rigorous, it is written in a tutorial style. Many useful, practical design and analysis equations for both passive and active sonar systems are derived from first principles. No major steps in the derivation of important results are skipped – all assumptions and approximations are clearly stated. Particular attention is paid to the correct units for functions and parameters. Many figures, tables, examples, and practical homework problems at the end of each chapter are included to aid in the understanding of the material covered. New to the Second Edition Chapter 15 Synthetic-Aperture Sonar Chapter 13, Section 13.3, The Rectangular-Envelope HFM Pulse Chapter 10, Section 10.7, Moving Platforms, was rewritten, which allowed for the elimination of Appendix 10C from the first edition New explanations/discussions were added to Subsections 1.2.1 and 1.3.1 in Chapter 1 Appendix 1A was rewritten and the new Table 1A-1 was added to Chapter 1 A solutions manual is available for adopting professors

Applied Underwater Acoustics meets the needs of scientists and engineers working in underwater acoustics and graduate students solving problems in, and preparing theses on, topics in underwater acoustics. The book is structured to provide the basis for rapidly assimilating the essential underwater acoustic knowledge base for practical application to daily research and analysis. Each chapter of the book is self-supporting and focuses on a single topic and its relation to underwater acoustics. The chapters start with a brief description of the topic's physical background, necessary definitions, and a short description of the applications, along with a roadmap to the chapter. The subtopics covered within individual subchapters include most frequently used equations that describe the topic. Equations are not derived, rather, assumptions behind equations and limitations on the applications of each equation are emphasized. Figures, tables, and illustrations related to the sub-topic are presented in an easy-to-use manner, and examples on the use of the equations, including appropriate figures and tables are also included. Provides a complete and up-to-date treatment of all major subjects of underwater acoustics Presents chapters written by recognized experts in their individual field Covers the fundamental knowledge scientists and engineers need to solve problems in underwater acoustics Illuminates, in shorter sub-chapters, the modern applications of underwater acoustics that are described in worked examples Demands no prior knowledge of underwater acoustics, and the physical principles and mathematics are designed to be readily understood by scientists, engineers, and graduate students of underwater acoustics Includes a comprehensive list of literature references for each chapter

The most comprehensive book on electroacoustic transducers and arrays for underwater sound Includes transducer modeling techniques and transducer designs that are currently in use Includes discussion and analysis of array interaction and nonlinear effects in transducers Contains extensive data in figures and tables needed in transducer and array design Written at a level that will be useful to students as well as to practicing engineers and scientists

Underwater Acoustic Sensor Networks

Modeling, Detection, and Estimation

Proceedings of the NATO Advanced Study Institute held at Kollokollen, Copenhagen, Denmark, August 18–29, 1980

Mechanics of Underwater Noise

Adaptive Methods in Underwater Acoustics

This book describes, using first-person accounts, the history of the development in the Soviet Union and, later, in Russia of an extremely important technical field and how that history was influenced by WWI, WWII, and the Cold War, by government bureaucracy, in both positive and negative ways, by

the economic collapse of the Soviet Union, and most importantly, by the dedicated efforts of vast numbers of individuals, including some of the greatest scientific minds of the 20th century. It will make fascinating reading for engineers and scientists who were engaged in similar work in the West, for historians of the Cold War and of the Soviet Union, and for present day researchers who need to learn about Russian scientific contributions. Because of its importance to national security, much of the research and development effort in underwater acoustics was classified during the Cold War, both in the Soviet Union and the United States. This book presents the first declassified accounts of the development of numerous hydroacoustic systems by individuals having first-hand knowledge of the development efforts.

Presented in a clear and concise way as an introductory text and practical handbook, the book provides the basic physical phenomena governing underwater acoustical waves, propagation, reflection, target backscattering and noise. It covers the general features of sonar systems, transducers and arrays, signal processing and performance evaluation. It provides an overview of today's applications, presenting the working principles of the various systems. From the reviews: "Presented in a clear and concise way as an introductory text and practical handbook, the book provides the basic physical phenomena governing underwater acoustical waves, propagation, reflection, target backscattering and noise. ... It provides an overview of today's applications, presenting the working principles of the various systems." (Oceanis, Vol. 27 (3-4), 2003) "This book is a general survey of Underwater Acoustics, intended to make the subject 'as easily accessible as possible, with a clear emphasis on applications.' In this the author has succeeded, with a wide variety of subjects presented with minimal derivation There is an emphasis on technology and on intuitive physical explanation" (Darrell R. Jackson, Journal of the Acoustic Society of America, Vol. 115 (2), February, 2004) "This is an exciting new scientific publication. It is timely and welcome Furthermore, it is up to date and readable. It is well researched, excellently published and ranks with earlier books in this discipline Many persons in the marine science field including acousticians, hydrographers, oceanographers, fisheries scientists, engineers, educators, students ... and equipment manufacturers will benefit greatly by reading all or part of this text. The author is to be congratulated on his fine contribution" (Stephen B. MacPhee, International Hydrographic Review, Vol. 4 (2), 2003)

A detailed review of underwater channel characteristics, Underwater Acoustic Sensor Networks investigates the fundamental aspects of underwater communication. Prominent researchers from around the world consider contemporary challenges in the development of underwater acoustic sensor networks (UW-ASNs) and introduce a cross-layer approach for effective integration of all communication functionalities. Discussing architectures for two- and three-dimensional sensor networks, this authoritative resource clearly delineates the main differences between terrestrial and underwater sensor networks—covering the wide range of topics related to UW-ASNs. It examines efficient distributed routing algorithms for delay-insensitive and delay-sensitive applications and introduces a realistic acoustic model characterized by channel utilization efficiency that enables proper setting of the optimal packet size for underwater communication. It also: Provides efficient sensor communication protocols for the underwater environment Addresses the topology control problem for sparse and dense 3D networks Presents a novel distributed MAC protocol that incorporates a unique closed-loop distributed algorithm for setting the optimal transmit power and code length The book includes coverage of routing, fault tolerance, time synchronization, optimal clustering, medium access control, software, hardware, and channel modeling. Exploring the need to design an energy-efficient cross-layer protocol suite, this resource provides the understanding required to achieve high-performance channel access, routing, event transport reliability, and data flow control with underwater acoustic sensors.

Written in tutorial style, this textbook discusses the fundamental topics of modern day Sonar Systems Engineering for the analysis and design of both active and passive sonar systems. Included are basic signal design for active sonar systems and understanding underwater acoustic communication signals. Mathematical theory is provided, plus practical design and analysis equations for both passive and active sonar systems. Practical homework problems are included at the end of each chapter and a solutions manual and lecture slides for each chapter are available for adopting professors.

Introduction to Underwater Acoustics

Hydrophones - Their Characteristics and Applications : Calibration Techniques

Ocean Acoustic Propagation by Finite Difference Methods

Applied Underwater Acoustics

Modeling and Measurement Methods for Acoustic Waves and for Acoustic Microdevices

This book provides up-to-date information as well as introduction to underwater acoustics, which is described as the analysis of the propagation of sound in water and the interplay of the mechanical waves that constitute sound with the water and its boundaries. A wide range of topics are encompassed in this book like localization of buried objects in sediment with the help of high resolution array processing techniques, underwater acoustic source localization, adaptive strategy for underwater acoustic communication, etc. Researchers and scientists from across the world have contributed valuable data and information in this all-inclusive book. The

aim of this elucidative book is to serve as a useful source of reference for readers including researchers, students and even scientists who are interested in acquiring knowledge regarding this field.

Acoustics is a mature field which enjoys a never ending youth. New developments are induced by either the search for a better understanding, or by technological innovations. Micro-fabrication techniques introduced a whole new class of microdevices, which exploit acoustic waves for various tasks, and in particular for information processing and for sensing purposes. Performance improvements are achievable by better modelling tools, able to deal with more complex configurations, and by more refined techniques of fabrication and of integration in technological systems, like wireless communications. Several chapters of this book deal with modelling and fabrication techniques for microdevices, including unconventional phenomena and configurations. But this is far from exhausting the research lines in acoustics. Theoretical analyses and modelling techniques are presented, for phenomena ranging from the detection of cracks to the acoustics of the oceans. Measurement methods are also discussed, which probe by acoustic waves the properties of widely different systems.

Sonar performance modelling (SPM) is concerned with the prediction of quantitative measures of sonar performance, such as probability of detection. It is a multi-disciplinary subject, requiring knowledge and expertise in the disparate fields of underwater acoustics, acoustical oceanography, sonar signal processing and statistical detection theory. No books have been published on this subject, however, since the 3rd edition of Urick ' s classic work 25 years ago and so Dr Ainslie ' s book will fill a much-needed gap in the market. Currently, up-to-date information can only be found, in different forms and often with conflicting information, in various journals, conference and textbook publications. Dr Michael Ainslie is eminently qualified to write this unique book. He has worked on sonar performance modeling problems since 1983. He has written many peer reviewed research articles and conference papers related to sonar performance modeling, making contributions in the fields of sound propagation and detection theory.

Humans have always been fascinated by marine life, from extremely small diatoms to the largest mammal that inhabits our planet, the blue whale. However, studying marine life in the ocean is an extremely difficult proposition because an ocean environment is not only vast but also opaque to most instruments and can be a hostile environment in which to perform experiments and research. The use of acoustics is one way to effectively study animal life in the ocean. Acoustic energy propagates in water more efficiently than almost any form of energy and can be utilized by animals for a variety of purposes and also by scientists interested in studying their behavior and natural history. However, underwater acoustics have traditionally been in the domain of physicists, engineers and mathematicians. Studying the natural history of animals is in the domain of biologists and physiologists. Understanding behavior of animals has traditionally involved psychologists and zoologists. In short, marine bioacoustics is and will continue to be a diverse discipline involving investigators from a variety of backgrounds, with very different knowledge and skill sets. The inherent inter-disciplinary nature of marine bioacoustics presents a large challenge in writing a single text that would be meaningful to various investigators and students interested in this field. Yet we have embarked on this challenge to produce a volume that would be helpful to not only beginning investigators but to seasoned researchers.

Analysis, Design and Performance of Sonar

An Introduction to Underwater Acoustics

Transducers and Arrays for Underwater Sound

Computational Ocean Acoustics

Ocean Ambient Noise

This definitive textbook provides students with a comprehensive introduction to acoustics. Beginning with the basic physical ideas, Acoustics balances the fundamentals with engineering aspects, applications and electroacoustics, also covering music, speech and the properties of human hearing. The concepts of acoustics are exposed and applied in: room acoustics sound insulation in buildings noise control underwater sound and ultrasound Scientifically thorough, but with mathematics kept to a minimum, Acoustics is the perfect introduction to acoustics for students at any level of mechanical, electrical or civil engineering courses and an accessible resource for architects, musicians or sound engineers requiring a technical understanding of acoustics and their applications.

This corrected version of the landmark 1981 textbook introduces the physical principles and theoretical basis of acoustics with deep mathematical rigor, concentrating on concepts and points of view that have proven useful in applications such as noise control, underwater sound, architectural acoustics, audio engineering, nondestructive testing, remote sensing, and medical ultrasonics. Since its publication, this text has been used as part of numerous acoustics-related courses across the world, and continues to be used widely today. During its writing, the book was fine-tuned according to insights gleaned from a broad range of classroom settings. Its careful design supports students in their pursuit of a firm foundation while allowing flexibility in course structure. The book can easily be used in single-term or full-year graduate courses and includes problems and answers. This rigorous and essential text is a must-have for any practicing or aspiring acoustician.

Underwater Acoustic Modeling and Simulation (5th edition) examines the translation of our physical understanding of sound in the sea into mathematical models that can simulate acoustic propagation, noise, and reverberation in the ocean. These models are used in a variety of research and operational applications to predict and diagnose the performance of complex sonar systems operating in the undersea environment. This fifth edition addresses advances in the development and utilization of underwater acoustic models since 2013. The inventory of underwater acoustic models has increased by approximately 10 percent over this period, thus demonstrating a continued expansion of related research and development activities. Major new developments are described in newly created subsections of the existing chapters. This book is intended for those who have a fundamental understanding of underwater acoustics, but who are not yet familiar with the various aspects of modeling. The level of technical detail presented in this book is appropriate for a broad spectrum of practitioners and students in sonar technology, acoustical oceanography, marine engineering, naval operations analysis, systems engineering, and applied mathematics. Sufficient mathematical derivations are included to demonstrate model formulations, and guidelines are provided to assist in the selection and proper application of these models. Updated inventory of underwater acoustic models available for current research and development activities. Discussion of specific examples of each type of model to illustrate model formulations, assumptions, and algorithm efficiency. Instructions in the proper application of models and the correct interpretation of results to assess prediction uncertainties. Demonstration of how underwater acoustic models can serve as enabling tools for assessing noise impacts on the ocean soundscape. Inclusion of updated discussion and analytic questions in each chapter to help students assess their comprehension.

Presented in a clear and concise way as an introductory text and practical handbook, the book provides the basic physical phenomena governing underwater acoustical waves, propagation,

reflection, target backscattering and noise. It covers the general features of sonar systems, transducers and arrays, signal processing and performance evaluation. It provides an overview of today's applications, presenting the working principles of the various systems. From the reviews: "Presented in a clear and concise way as an introductory text and practical handbook, the book provides the basic physical phenomena governing underwater acoustical waves, propagation, reflection, target backscattering and noise. It provides an overview of today's applications, presenting the working principles of the various systems." (Oceanis, Vol. 27 (3-4), 2003) "This book is a general survey of Underwater Acoustics, intended to make the subject as easily accessible as possible, with a clear emphasis on applications. In this the author has succeeded, with a wide variety of subjects presented with minimal derivation. There is an emphasis on technology and on intuitive physical explanation." (Darrell R. Jackson, Journal of the Acoustic Society of America, Vol. 115 (2), February, 2004) "This is an exciting new scientific publication. It is timely and welcome. Furthermore, it is up to date and readable. It is well researched, excellently published and ranks with earlier books in this discipline. Many persons in the marine science field including acousticians, hydrographers, oceanographers, fisheries scientists, engineers, educators, students and equipment manufacturers will benefit greatly by reading all or part of this text. The author is to be congratulated on his fine contribution." (Stephen B. MacPhee, International Hydrographic Review, Vol. 4 (2), 2003)

OFDM for Underwater Acoustic Communications

An Introduction

Underwater Acoustic Systems

A Linear Systems Theory Approach

An Introduction to Sonar Systems Engineering

The NATO Advanced Study Institute on Adaptive Methods in Underwater Acoustics was held on 30 July - 10 August 1984 in LLineburg, Germany. The Institute was primarily concerned with signal processing for underwater applications. The majority of the presentations, when taken together, yield a definite picture of the present status of understanding of adaptive and high resolution processing, setting out the progress achieved over the past four years together with the major problem areas remaining. Major effort was made to obtain a commensurate contribution of tutorial and advanced research papers. It is my hope that the material in this volume may be equally well suited for students getting an introduction to some of the basic problems in underwater signal processing and for the professionals who may obtain an up-to-date overview of the present state of the art. This might be especially useful in view of the controversy and lack of adequate interrelationships which have marked this rapidly expanding field in the past. Practical reinforcement of this picture is provided by the material concerning digital and optical processing technology, giving some guidance to achievable adaptive and high resolution techniques with current processing devices. The formal programme was extended and detailed by a series of six evening work shops on specific topics, during which informal discussions took place among the participants. Summaries of these workshops are also included in these Proceedings.

This volume constitutes a series of invited chapters based on presentations given at an International Conference on the Sensory Biology of Aquatic Animals held June 24-28, 1985 at the Mote Marine Laboratory in Sarasota, Florida. The immediate purpose of the conference was to spark an exchange of ideas, concepts, and techniques among investigators concerned with the different sensory modalities employed by a wide variety of animal species in extracting information from the aquatic environment. By necessity, most investigators of sensory biology are specialists in one sensory system: different stimulus modalities require different methods of stimulus control and, generally, different animal models. Yet, it is clear that all sensory systems have principles in common, such as stimulus filtering by peripheral structures, tuning of receptor cells, signal-to-noise ratios, adaption and disadaptation, and effective dynamic range. Other features, such as hormonal and efferent neural control, circadian reorganization, and receptor recycling are known in some and not in other senses. The conference afforded an increased awareness of new discoveries in other sensory systems that has effectively inspired a fresh look by the various participants at their own area of specialization to see whether or not similar principles apply. This inspiration was found not only in theoretical issues, but equally in techniques and methods of approach. The myopy of sensory specialization was broken in one unexpected way by showing limitations of individual sense organs and their integration within each organism. For instance, studying vision, one generally chooses a visual animal as a model.

Underwater Acoustics: A Linear Systems Theory Approach is an interdisciplinary and approachable textbook dedicated to the subject of underwater acoustics as well as its applications and research. The book, after giving an introduction and background discussion on underwater topics, covers specific areas such as the fundamentals of linear, space-variant, and time-variant filters; complex apertures; and linear, planar, and volume arrays. Also covered in the book are topics such as signal processing; wave propagation in inhomogeneous media; and random ocean medium transfer functions. Because of its interdisciplinary approach, the text is applicable for students in the fields of electrical engineering, ocean engineering, acoustics, and oceanography who are interested in underwater acoustics and sonar systems engineering.

This monograph develops the theory of noise mechanisms and measurements, and describes general noise characteristics and computational methods. The vast ambient noise literature is concisely summarized using theory combined with key representative results. The air sea boundary interaction zone is described in terms of nondimensional variables requisite for future experiments. Noise field coherency, rare directional measurements, and unique basin scale computations and methods are presented. The use of satellite measurements in these basin scale models is demonstrated. A series of appendices provides in-depth mathematical treatments which will be of interest to graduate students and active researchers.

Acoustics

Handbook of Underwater Acoustic Engineering
Digital Sonar Design in Underwater Acoustics
Leif Bjørnø

This is an unparalleled modern handbook reflecting the richly interdisciplinary nature of acoustics edited by an acknowledged master in the field. The handbook reviews the most important areas of the subject, with emphasis on current research. The authors of the various chapters are all experts in their fields. Each chapter is richly illustrated with figures and tables. The latest research and applications are incorporated throughout, including computer recognition and synthesis of speech, physiological acoustics, diagnostic imaging and therapeutic applications and acoustical oceanography. An accompanying CD-ROM contains audio and video files. For the 119 species of marine mammals, as well as for some other aquatic animals, sound is the primary means of learning about the environment and of communicating, navigating, and foraging. The possibility that human-generated noise could harm marine mammals or significantly interfere with their normal activities is an issue of increasing concern. Noise and its potential impacts have been regulated since the passage of the Marine Mammal Protection Act of 1972. Public awareness of the issue escalated in 1990s when researchers began using high-intensity sound to measure ocean climate changes. More recently, the stranding of beaked whales in proximity to Navy sonar use has again put the issue in the spotlight. Ocean Noise and Marine Mammals reviews sources of noise in the ocean environment, what is known of the responses of marine mammals to acoustic disturbance, and what models exist for describing ocean noise and marine mammal responses. Recommendations are made for future data gathering efforts, studies of marine mammal behavior and physiology, and modeling efforts necessary to determine what the long- and short-term impacts of ocean noise on marine mammals.

Offering complete and comprehensive coverage of modern sonar spectrum system analysis, Underwater Acoustics: Analysis, Design and Performance of Sonar provides a state-of-the-art introduction to the subject and has been carefully structured to offer a much-needed update to the classic text by Urick. Expanded to include computational approaches to the topic, this book treads the line between the highly theoretical and mathematical texts and the more populist, non-mathematical books that characterize the existing literature in the field. The author compares and contrasts different techniques for sonar design, analysis and performance prediction and includes key experimental and theoretical results, pointing the reader towards further detail with extensive references. Practitioners in the field of sonar design, analysis and performance prediction as well as graduate students and researchers will appreciate this new reference as an invaluable and timely contribution to the field. Chapters include the sonar equation, radiated, self and ambient noise, active sonar sources, transmission loss, reverberation, transducers, active target strength, statistical detection theory, false alarms, contacts and targets, variability and uncertainty, modelling detections and tactical decision aids, cumulative probability of detection, tracking target motion analysis and localization, and design and evaluation of sonars

Underwater Acoustic System Analysis provides a comprehensive exploration of underwater acoustics, acoustic signal generation, and acoustic signal processing for the practicing systems analyst and systems engineer. This second edition, first published in 1991, contains all the valuable information in the earlier edition plus a detailed discussion of adaptive processing as applied to spatial filtering. Highlights of the book are: * Generation and propagation of compressional acoustic waves in the ocean * narrowband signatures of surface ships caused by cavitating propeller blades and diesel engine firing * Optimization of signal-to-noise ratio and spatial resolution in the presence of multiple acoustic signals * Ambient noise in the ocean, and * Examples of system performance analysis

Underwater Acoustics

Hydrophones -their Characteristics and Applications and Calibration Technique

Sensory Biology of Aquatic Animals

Ocean Noise and Marine Mammals

High-Frequency Seafloor Acoustics

The continents of our planet have already been exploited to a great extent. Therefore man is turning his sight to the vast spaciousness of the ocean whose resources - mineral, biological, energetic, and others - are just beginning to be used. The ocean is being intensively studied. Our notions about the dynamics of ocean waters and their role in forming the Earth's climate as well as about the structure of the ocean bottom have substantially changed during the last two decades. An outstanding part in this accelerated exploration of the ocean is played by ocean acoustics. Only sound waves can propagate in water over large distances. Practically all kinds of telemetry, communication, location, and remote sensing of water masses and the ocean bottom use sound waves. Propagating over thousands of kilometers in the ocean, they bring information on earthquakes, eruptions of volcanoes, and distant storms. Projects using acoustical tomography systems for exploration of the ocean are presently being developed. Each of these systems will allow us to determine the three-dimensional structure of water masses in regions as large as millions of square kilometers.

A concise guide to the theory and application of numerical methods for predicting ocean acoustic propagation, also providing an introduction to numerical methods, with an overview of those methods presently in use. An in-depth development of the implicit-finite-difference technique is presented together with bench-mark test examples included to demonstrate its application to realistic ocean environments. Other applications include atmospheric acoustics, plasma physics, quantum mechanics, optics and seismology.

"Digital Sonar Design in Underwater Acoustics Principles and Applications" provides comprehensive and up-to-date coverage of research on sonar design, including the basic theory and techniques of digital signal processing, basic concept of information theory, ocean acoustics, underwater acoustic signal propagation theory, and underwater signal processing theory. This book discusses the general design procedure and approaches to implementation, the design method, system simulation theory and techniques, sonar tests in the laboratory, lake and sea, and practical validation criteria and methods for digital sonar design. It is intended for researchers in the fields of underwater signal processing and sonar design, and also for navy officers and ocean explorers. Qihu Li is a professor at the Institute of Acoustics, Chinese Academy of Sciences, and an academican of the Chinese Academy of Sciences.

An Introduction to Underwater Acoustics Principles and Applications Springer Science & Business Media

Underwater Acoustic Signal Processing

Underwater Acoustics and Signal Processing

Sonar and Underwater Acoustics

Principles of Underwater Sound

Digital Underwater Acoustic Communications

Part of a series which is aimed primarily at a professional engineering or postgraduate student audience, this book concerns the basics of the propagation of sound in the sea, the problems of waveform analysis, underwater acoustic equipment and underwater acoustic communication.

Mechanics of Underwater Noise elucidates the basic mechanisms by which noise is generated, transmitted by structures and radiated into the sea. Organized into 10 chapters, this book begins with a description of noise, decibels and levels, significance of spectra, and passive sonar equation. Subsequent chapters discuss sound waves in liquids; acoustic radiation fundamentals; wind-generated ocean ambient noise; vibration isolation and structural damping; and radiation by plate flexural vibrations. Other chapters address cavitation, propeller cavitation noise, radiation by fluctuating-force (dipole) sources, and mechanical noise sources. This book will be helpful as a self-education text and as a reference for workers in the field.

Senior level/graduate level text/reference presenting state-of-the-art numerical techniques to solve the wave equation in heterogeneous fluid-solid media. Numerical models have become standard research tools in acoustic laboratories, and thus computational acoustics is becoming an increasingly important branch of ocean acoustic science. The first edition of this successful book, written by the recognized leaders of the field, was the first to present a comprehensive and modern introduction to computational ocean acoustics accessible to students. This revision, with 100 additional pages, completely updates the material in the first edition and includes new models based on current research. It includes problems and solutions in every chapter, making the book more useful in teaching (the first edition had a separate solutions manual). The book is intended for graduate and advanced undergraduate students of acoustics, geology and geophysics, applied mathematics, ocean engineering or as a reference in computational methods courses, as well as professionals in these fields, particularly those working in government (especially Navy) and industry labs engaged in the development or use of propagating models.

A blend of introductory material and advanced signal processing and communication techniques, of critical importance to underwater system and network development This book, which is the first to describe the processing techniques central to underwater OFDM, is arranged into four distinct sections: First, it describes the characteristics of underwater acoustic channels, and stresses the difference from wireless radio channels. Then it goes over the basics of OFDM and channel coding. The second part starts with an overview of the OFDM receiver, and develops various modules for the receiver design in systems with single or multiple transmitters. This is the main body of the book. Extensive experimental data sets are used to verify the receiver performance. In the third part, the authors discuss applications of the OFDM receiver in i) deep water channels, which may contain very long

separated multipath clusters, ii) interference-rich environments, where an unintentional interference such as Sonar will be present, and iii) a network with multiple users where both non-cooperative and cooperative underwater communications are developed. Lastly, it describes the development of a positioning system with OFDM waveforms, and the progress on the OFDM modem development. Closely related industries include the development and manufacturing of autonomous underwater vehicles (AUVs) and scientific sensory equipment. AUVs and sensors in the future could integrate modems, based on the OFDM technology described in this book. Contents includes: Underwater acoustic channel characteristics/OFDM basics/Peak-to-average-ratio control/Detection and Doppler estimation (Doppler scale and CFO)/Channel estimation and noise estimation/A block-by-block progressive receiver and performance results/Extensions to multi-input multi-output OFDM/Receiver designs for multiple users/Cooperative underwater OFDM (Physical layer network coding and dynamic coded cooperation)/Localization with OFDM waveforms/Modem developments A valuable resource for Graduate and postgraduate students on electrical engineering or physics courses; electrical engineers, underwater acousticians, communications engineers

Principles of Sonar Performance Modelling

Springer Handbook of Acoustics

Fundamentals of Ocean Acoustics

Measurement and Theory

History of Russian Underwater Acoustics

This book provides comprehensive coverage of the detection and processing of signals in underwater acoustics. Background material on active and passive sonar systems, underwater acoustics, and statistical signal processing makes the book a self-contained and valuable resource for graduate students, researchers, and active practitioners alike. Signal detection topics span a range of common signal types including signals of known form such as active sonar or communications signals; signals of unknown form, including passive sonar and narrowband signals; and transient signals such as marine mammal vocalizations. This text, along with its companion volume on beamforming, provides a thorough treatment of underwater acoustic signal processing that speaks to its author's broad experience in the field.

This book is a research monograph on high-Frequency Seafloor Acoustics. It is the first book in a new series sponsored by the Office of Naval Research on the latest research in underwater acoustics. It provides a critical evaluation of the data and models pertaining to high-frequency acoustic interaction with the seafloor, which will be of interest to researchers in underwater acoustics and to developers of sonars. Models and data are presented so as to be readily usable, backed up by extensive explanation. Much of the data is new, and the discussion is on two levels: concise descriptions in the main text backed up by extensive technical appendices.

Underwater Acoustic Modeling and Simulation, Fourth Edition continues to provide the most authoritative overview of currently available propagation, noise, reverberation, and sonar-performance models. This fourth edition of a bestseller discusses the fundamental processes involved in simulating the performance of underwater acoustic systems and emphasizes the importance of applying the proper modeling resources to simulate the behavior of sound in virtual ocean environments. New to the Fourth Edition Extensive new material that addresses recent advances in inverse techniques and marine-mammal protection Problem sets in each chapter Updated and expanded inventories of available models Designed for readers with an understanding of underwater acoustics but who are unfamiliar with the various aspects of modeling, the book includes sufficient mathematical derivations to demonstrate model formulations and provides guidelines for selecting and using the models. Examples of each type of model illustrate model formulations, model assumptions, and algorithm efficiency. Simulation case studies are also included to demonstrate practical applications. Providing a thorough source of information on modeling resources, this book examines the translation of our physical understanding of sound in the sea into mathematical models that simulate acoustic propagation, noise, and reverberation in the ocean. The text shows how these models are used to predict and diagnose the performance of complex sonar systems operating in the undersea environment.

Digital Underwater Acoustic Communications focuses on describing the differences between underwater acoustic communication channels and radio channels, discusses loss of transmitted sound in underwater acoustic channels, describes digital underwater acoustic communication signal processing, and provides a comprehensive reference to digital underwater acoustic communication equipment. This book is designed to serve as a reference for postgraduate students and practicing engineers involved in the design and analysis of underwater acoustic communications systems as well as for engineers involved in underwater acoustic engineering. Introduces the basics of underwater acoustics, along with the advanced functionalities needed to achieve reliable communications in underwater environment Identifies challenges in underwater acoustic channels relative to radio channels, underwater acoustic propagation, and solutions Shows how multi-path structures can be thought of as time diversity signals Presents a new, robust signal processing system, and an advanced FH-SS system for multimedia underwater acoustic communications with moderate communication ranges (above 20km) and rates (above 600bps) Describes the APNFM system for underwater acoustic communication equipment (including both civil and military applications), to be employed in active

sonar to improve its performance

Underwater Acoustic Modeling and Simulation

Underwater Acoustic System Analysis

Principles and Applications

An Introduction to Its Physical Principles and Applications

Principles of Marine Bioacoustics

Good, No Highlights, No Markup, all pages are intact, Slight Shelfwear, may have the corners slightly dented, may have slight color changes/slightly damaged spine.

Sonar and Underwater Acoustics brings together all the concepts necessary for designers and users of sonar systems. Unlike other books on this subject, which are often too specialized, this book is accessible to a wider audience. The first part focuses on the acoustic environment, antenna structures, and electric acoustic interface. The latter provides knowledge required to design, as well as the development and implementation of chain processes for an active sonar from the conditioning input to output processing. The reader will find a comprehensive range of all problems encountered in underwater acoustics for a sonar application, from physical phenomena governing the environment and the corresponding constraints, through to the technical definition of transducers and antennas, and the types of signal processing involved. In one section, measures in underwater acoustics are also proposed.