

# Shallow-Water Acoustics

Boris G. Katsnelson  
and  
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Springer

PRAXIS

# Shallow Water Acoustics

**John Brackett Hersey**



## **Shallow Water Acoustics:**

*Fundamentals of Shallow Water Acoustics* Boris Katsnelson, Valery Petnikov, James Lynch, 2012-02-22 Shallow water acoustics SWA the study of how low and medium frequency sound propagates and scatters on the continental shelves of the world's oceans has both technical interest and a large number of practical applications Technically shallow water poses an interesting medium for the study of acoustic scattering inverse theory and propagation physics in a complicated oceanic waveguide Practically shallow water acoustics has interest for geophysical exploration marine mammal studies and naval applications Additionally one notes the very interdisciplinary nature of shallow water acoustics including acoustical physics physical oceanography marine geology and marine biology In this specialized volume the authors all of whom have extensive at sea experience in US and Russian research efforts have tried to summarize the main experimental theoretical and computational results in shallow water acoustics with an emphasis on providing physical insight into the topics presented

**Shallow Water Acoustics** Boris G. Katsnelson, Valery G. Petnikov, 2002-05-01 The objective of this book is to present the main theoretical approaches and models in shallow water acoustics as well as different experimental results The focus is primarily concentrated on physical results describing the sound field in wave length The authors show dynamic phenomena tides internal waves from the perspective of acoustic influence as well as the scattering of sound over the macroscopic body in shallow water waveguide The method of acoustic probing can be used by physicists geophysicists geologists and oceanographers

**Futures in Shallow-water Acoustics** John Brackett Hersey, 1987      **Some Perspectives and Recent Findings in Shallow Water Acoustics** Robert Joseph Urick, 1971      *Shallow-water Acoustics* Renhe Zhang, 1997

**Shallow-water Acoustics** James F. Lynch, 1997      Shallow Water Acoustics Jeffrey Simmen, Ellen S. Livingston, Ji-Xun Zhou, Feng-Hua Li, 2010-10-04 Undersea acoustic applications in shallow water to detect communicate navigate monitor and measure are dependent upon a good physical understanding of sound propagation and scattering in this highly dynamic and inhomogeneous waveguide Achieving such an understanding requires an interdisciplinary approach encompassing acoustics physical oceanography marine geophysics marine biology ocean engineering and signal processing as well as the underlying physics and mathematics of the integrated theory      Oceanographic Variability in Shallow-Water Acoustics and the Dual Role of the Sea Bottom, 1993 Acoustic propagation in shallow water is an area of major concern to the Navy The difficulties associated with the use of acoustics in the ocean however are aggravated in shallow water Multipath propagation and extensive boundary interactions especially with the sea bottom conspire along with a host of other phenomena to produce a highly variable and often unpredictable acoustic field The responsible mechanisms and hence the acoustic effects cover a wide range of temporal and spatial scales The mechanisms are classified as either deterministic or random although the two types often act in concert The sea bottom plays a dual role in shallow water acoustics Because of extensive interactions with the sound field the bottom can severely degrade waterborne propagation On the other hand the sea bottom and subbottom

can provide a seismic path that not only is relatively stable but exists even under environmental conditions that preclude an effective waterborne path Propagation in the bottom is particularly significant at very low frequencies often being more efficient than high frequency waterborne propagation The preceding aspects of shallow water acoustics viz variability and dual role of the sea bottom are illustrated using the results of experiments conducted in diverse geographic areas by the Naval Research Laboratory SSC and by the SACLANT Undersea Research Centre Seismic waves Scholte waves Seismic arrays

**Acoustic Sensing Techniques for the Shallow Water Environment** Andrea Caiti,N. Ross Chapman,Jean-Pierre Hermand,Sérgio M. Jesus,2006-09-21 This volume contains the collection of papers from the second workshop on Experimental Acoustic Inversion Techniques for Exploration of the Shallow Water Environment Acoustic techniques provide the most effective means for remote sensing of ocean and sea floor processes and for probing the structure beneath the sea floor No other energy propagates as efficiently in the ocean radio waves and visible light are severely limited in range because the ocean is a highly conductive medium However sound from breaking waves and coastal shipping can be heard throughout the ocean and marine mammals communicate acoustically over basin scale distances The papers in this book indicate a high level of research interest that has generated significant progress in development and application of experimental acoustic inversion techniques The applications span a broad scope in geosciences from geophysical biological and even geochemical research The list includes estimation of geotechnical properties of sea bed materials navigation and mapping of the sea floor fisheries aquaculture and sea bed habitat assessment monitoring of marine mammals sediment transport and investigation of natural geohazards in marine sediments Audience This book is primarily intended for physicists and engineers working in underwater acoustics and oceanic engineering It will also be of interest to marine biologists geophysicists and oceanographers as potential users of the methodologies and techniques described in the book contributions

**Shallow Water Acoustics** Naval Research Laboratory (U.S.). Applied Ocean Acoustics Branch,1978

**Shallow Water Acoustics** F. Ingenito,R. H. Ferris,W. A. Kuperman,S. N. Wolf,NAVAL RESEARCH LAB WASHINGTON D C.,1978 In response to the Navy's need for a submarine warfare capability in shallow water areas of the oceans NRL has been conducting a research program in shallow water acoustics The goal of the first phase of this program has been to determine if wave theory can be used to predict the acoustic field at long ranges from a submerged acoustic source The approach used an iterative process involving trial models and at sea measurements The wave equation for the physical model is solved by numerical methods and implemented on a high speed general purpose computer Since the acoustic field at long ranges is propagated in the discrete normal modes of the duct special experimental methods were used to resolve individual modal fields so that their measured characteristics could be compared with predictions This report presents a detailed description of the NRL normal mode model in its current form and describes the experimental evaluation procedures and results Salient features of the model include variable sound speed in the water slowly variable water depth statistically rough

boundaries sediment layering and both shear wave and compressional wave propagation in the bottom Although certain recognized problems remain to be solved it has been demonstrated that the model can in most cases predict the characteristics of the signal field with sufficient accuracy to be a useful tool in system design performance prediction and tactics

**Author Low-Frequency Shallow Water Acoustics (20 to 500 Hz).** M. Schulkin, J. A. Mercer, WASHINGTON UNIV SEATTLE APPLIED PHYSICS LAB., 1986 The parameters affecting shallow water acoustic behavior at low frequencies 20 to 500 Hz have been reviewed The depth dependence of the sediment parameters and stratigraphic layering in depth form the basis of geoacoustic models for which the wave equation may be solved There is no unique approach to geoacoustic modeling Typically the additional information required includes in situ refraction dispersion and reflection requirements Application of the Biot theory of sediment acoustics which uses poroviscous parameters leads to different conclusions in the frequency range of interest from those calculated using standard viscoelastic parameters alone The Biot acoustic theory also explains successful data fits to semiempirical compressional and shear wave results The most important sediment property is the flow permeability which is equal to the choice of acoustic frequency in its effect Its range of variability is so large that it is necessary to make a specific in situ determination of its magnitude for use in modeling and prediction The permeability controls the relaxation frequency of the sediment and thus the rate of attenuation of both compressional and shear waves their frequency dependence and their velocity dispersion Next in importance are the shear properties of the sediments their related interface waves and the skeletal frame loss Determination of these parameters in situ and further study in the laboratory are most important for progress

**Special Issue on Shallow-water Acoustics** E. C. Shang, Chi-Fang Chen, 2010 *Shallow Water Acoustics* Office of Naval Research, **Applied Underwater Acoustics** Thomas Neighbors, David Bradley, 2017-01-19 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

*Shallow Water Acoustics Experiment 2006* , Shallow Water Acoustic Amplitude Fluctuations at 35 and 65 KHz Michael Thomas Korbet,NAVAL POSTGRADUATE SCHOOL MONTEREY CALIF.,1974 An underwater acoustics experiment conducted in shallow water 70 feet off the New Zealand east coast in 1972 1973 is described Short acoustic pulses of 35 and 65 kHz sound were projected along near orthogonal paths of approximately 300 yards Environmental parameters were simultaneously observed Statistical and spectral analyses of pulse heights were performed on 12 selected runs using digital techniques Microscale temperature fluctuations measured simultaneously are discussed Modified author abstract

*A History of the Acoustics Division of the Naval Research Laboratory* Fred Tudor Erskine,2013 *Underwater Acoustic Modeling and Simulation* Paul C. Etter,2017-12-19 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

Application of the Boundary Element Method to Shallow-water Acoustics Xiaocheng Liu,1993

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