

Edmund J. Sullivan

Model-Based Processing for Underwater Acoustic Arrays



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Model Based Processing For Underwater Acoustic Arrays

Springerbriefs In Physics

Paul C. Etter

Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics:

Model-Based Processing for Underwater Acoustic Arrays Edmund J. Sullivan, 2015-05-14 This monograph presents a unified approach to model based processing for underwater acoustic arrays. The use of physical models in passive array processing is not a new idea but it has been used on a case by case basis and as such lacks any unifying structure. This work views all such processing methods as estimation procedures which then can be unified by treating them all as a form of joint estimation based on a Kalman type recursive processor which can be recursive either in space or time depending on the application. This is done for three reasons. First the Kalman filter provides a natural framework for the inclusion of physical models in a processing scheme. Second it allows poorly known model parameters to be jointly estimated along with the quantities of interest. This is important since in certain areas of array processing already in use such as those based on matched field processing the so called mismatch problem either degrades performance or indeed prevents any solution at all. Thirdly such a unification provides a formal means of quantifying the performance improvement. The term model based will be strictly defined as the use of physics based models as a means of introducing a priori information. This leads naturally to viewing the method as a Bayesian processor. Short expositions of estimation theory and acoustic array theory are presented followed by a presentation of the Kalman filter in its recursive estimator form. Examples of applications to localization, bearing estimation, range estimation and model parameter estimation are provided along with experimental results verifying the method. The book is sufficiently self contained to serve as a guide for the application of model based array processing for the practicing engineer.

Model-Based Acoustic Array Processing, 2005 Underwater Acoustic Data Processing Y. T.

Chan, 2012-12-06 This book contains the papers that were accepted for presentation at the 1988 NATO Advanced Study Institute on Underwater Acoustic Data Processing held at the Royal Military College of Canada from 18 to 29 July 1988. Approximately 110 participants from various NATO countries were in attendance during this two week period. Their research interests range from underwater acoustics to signal processing and computer science some are renowned scientists and some are recent Ph D graduates. The purpose of the ASI was to provide an authoritative summing up of the various research activities related to sonar technology. The exposition on each subject began with one or two tutorials prepared by invited lecturers followed by research papers which provided indications of the state of development in that specific area. I have broadly classified the papers into three sections under the titles of I Propagation and Noise II Signal Processing and III Post Processing. The reader will find in Section I papers on low frequency acoustic sources and effects of the medium on underwater acoustic propagation. Problems such as coherence loss due to boundary interaction, wavefront distortion and multipath transmission were addressed. Besides the medium corrupting noise sources also have a strong influence on the performance of a sonar system and several researchers described methods of modeling these sources.

Application of Physics-Based Underwater Acoustic Signal and Array-Processing Techniques to Infrasound-Source Localization

,2001 The purpose of this project is to apply physics based signal and array processing techniques recently developed in the area of underwater acoustics to atmospheric infrasound data and co located seismic field data The source of the infrasound data is the newly installed International Monitoring System IMS infrasound station at Pinon Flat PFO The seismic data are being collected by the Southern California ANZA seismic network Installation of the eight sensors that comprise the infrasound station at PFO was completed by mid April of this year The space filters of the array 18 m for the inner centered triangle elements and 70 m for the outer centered triangle elements also are nearly all in place Preliminary data collected by this array contain some signals with significant spatial coherence across the array aperture In particular a large event with high signal to noise ratio was recorded on 23 April Analyses of the arrival structure of this signal are presented in this paper In addition the spatial and temporal properties of the background noise in relation to the local environmental conditions are discussed A focused experiment involving the temporary installation of additional infrasound sensors to provide larger array aperture is being planned for this summer A description of the planned experiment is presented below *Acoustic Signal Processing for Ocean Exploration* J.M.F Moura,Isabel M.G. Lourtie, Acoustic Signal Processing for Ocean Exploration has two major goals i to present signal processing algorithms that take into account the models of acoustic propagation in the ocean and ii to give a perspective of the broad set of techniques problems and applications arising in ocean exploration The book discusses related issues and problems focused in model based acoustic signal processing methods Besides addressing the problem of the propagation of acoustics in the ocean it presents relevant acoustic signal processing methods like matched field processing array processing and localization and detection techniques These more traditional contexts are herein enlarged to include imaging and mapping and new signal representation models like time frequency and wavelet transforms Several applied aspects of these topics such as the application of acoustics to fisheries sea floor swath mapping by swath bathymetry and side scan sonar autonomous underwater vehicles and communications in underwater are also considered

Underwater Acoustic Data Processing Y T Chan,1989 *Fundamentals of Underwater Acoustics* Orlando Camargo Rodríguez,2023-07-10 This textbook on Underwater Acoustics has a structure that is more organic than logical It thereby unifies diverse areas of research including topics of signal processing the sonar equation sources and receivers scattering and reverberation wave propagation propagation models and inverse problems It also provides code fragments written in Python which complement the discussion This is a book written for both beginners and specialists as well as for biologists oceanographers computer engineers physicists and mathematicians and for civilian and naval personnel who are looking for a introductory overview of the topic **Array Signal Processing** ,1985 **Underwater Acoustic Signal Processing** Douglas A. Abraham,2019 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 ***Computational Ocean Acoustics*** Finn B. Jensen, William A. Kuperman, Michael B. Porter, Henrik Schmidt, 2011-06-10 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 ***Array Signal Processing*** Underwater Acoustics Group. Conference, 1985 ***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 ***Underwater Acoustics and Ocean Dynamics*** Lisheng Zhou, Wen Xu, Qianliu Cheng, Hangfang Zhao, 2016-10-17 These proceedings are a collection of 16 selected

scientific papers and reviews by distinguished international experts that were presented at the 4th Pacific Rim Underwater Acoustics Conference PRUAC held in Hangzhou China in October 2013 The topics discussed at the conference include internal wave observation and prediction environmental uncertainty and coupling to sound propagation environmental noise and ocean dynamics dynamic modeling in acoustic fields acoustic tomography and ocean parameter estimation time reversal and matched field processing underwater acoustic localization and communication as well as measurement instrumentations and platforms These proceedings provide insights into the latest developments in underwater acoustics promoting the exchange of ideas for the benefit of future research **Underwater Acoustic Modelling and Simulation, Third Edition**

P.C. Etter,2003-12-08 Underwater Acoustic Modeling and Simulation 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 Previous editions of the book have provided invaluable guidance to sonar technologists acoustical oceanographers and applied mathematicians in the selection and application of underwater acoustic models Now that simulation is fast becoming an accurate efficient and economical alternative to field testing and at sea training this new edition will also provide useful guidance to systems engineers and operations analysts interested in simulating sonar performance Guidelines for selecting and using available propagation noise and reverberation models are highlighted Specific examples of each type of model are discussed to illustrate model formulations assumptions and algorithm efficiency Instructive case studies demonstrate applications in sonar simulation *Underwater Acoustic Modelling and Simulation* P.C. Etter,2003-12-08 Underwater Acoustic Modeling and Simulation 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 s

Underwater Acoustic Digital Signal Processing and Communication

Systems Robert Istepanian,Milica Stojanovic,2002-08-31 Underwater Acoustic Digital Signal Processing and Communication Systems describes new design and development methodologies in underwater acoustic signal processing The emphasis is on experimental efforts and modern DSP implementations The book assembles a number of contributions from authors who have contributed significantly to the field The topics cover a broad range of underwater acoustic signal processing applications underwater wireless communications array processing for mapping detection and localization of objects biotelemetry speech processing for divers acoustic imaging and use of neural networks for underwater signal processing

High-resolution Spatial Processing in Underwater Acoustics United States. Naval Ocean Research and Development Activity,1985 **High-resolution Methods in Underwater Acoustics** Michel Bouvet,1991 **Progress in Underwater Acoustics** Harold Merklinger,2012-12-06 IMAGE TRACKS AT HALIFAX by L B Felsen All living kind much

effort spend Some model modes some model rays To cope with their environment Some feel that spectra all portrays Some use their eyes some use their nose Then there are those who with despatch To sense where other things repose Take refuge in the ocean wedge For one group nothing s more profound Than to explore the world with sound If things get messy randomize These audio diagnosticians What s partly smooth determinize You ponder is it this or that Go by the name of acousticians And wish you were a lowly bat They regularly meet to check Whether their sonogram s on track The meeting s hosts did treat us well With images stored in their packs They let the climate cast its spell This year they came to Halifax No weath ry hope was placed in vain There they combined with ocean types We were exposed to wind and rain And each could hear the other s gripes We glimpsed blue sky through clouds dispersed A meeting naturally does start But rainy sequence was reversed Reviewing present state of art The ocean types would like it wet What we found out is where it s at Yet they got stuck with sun instead We cannot hope to match the bat Each confrence has the same refrain Computer printouts by the reams It has been fun to meet again

An Introduction to Underwater Acoustics Xavier Lurton, 2010-09-15 Sound waves are the only practical means of remote investigation of the sea and its bottom and transmission in seawater Underwater acoustics has become one of the major technologies used in the exploration and exploitation of the oceans for scientific industrial or military naval purposes It is widely employed in the fields of ocean engineering seafloor mapping defence oceanography navigation and fisheries Dr Xavier Lurton is a renowned specialist in underwater acoustics He has worked in this field as a scientist engineer project manager and teacher since 1981 and has participated in many scientific projects systems developments and at sea cruises In the second edition of his book Dr Lurton provides an updated and extended introduction to underwater acoustics including coverage of the physical processes and their basic modeling different underwater acoustic systems and their practical applications and a description and assessment of the various technologies Dr Lurton has extensive experience as a lecturer in undergraduate and postgraduate schools including naval academies This book is based on his direct first hand experience of the many aspects of underwater acoustics in seas around the world at the forefront of current research and development efforts

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Table of Contents Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics

1. Understanding the eBook Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - The Rise of Digital Reading Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Advantages of eBooks Over Traditional Books
2. Identifying Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - User-Friendly Interface

4. Exploring eBook Recommendations from Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Personalized Recommendations
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics User Reviews and Ratings
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics and Bestseller Lists
5. Accessing Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics Free and Paid eBooks
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics Public Domain eBooks
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics eBook Subscription Services
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics Budget-Friendly Options
6. Navigating Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics eBook Formats
 - ePUB, PDF, MOBI, and More
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics Compatibility with Devices
 - Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Highlighting and Note-Taking Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Interactive Elements Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
8. Staying Engaged with Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
9. Balancing eBooks and Physical Books Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain

- Minimizing Distractions
- Managing Screen Time

11. Cultivating a Reading Routine Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics

- Setting Reading Goals Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
- Carving Out Dedicated Reading Time

12. Sourcing Reliable Information of Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics

- Fact-Checking eBook Content of Model Based Processing For Underwater Acoustic Arrays Springerbriefs In Physics
- Distinguishing Credible Sources

13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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