



Underwater Acoustic Data Processing

Edited by
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Underwater Acoustic Data Processing

William S. Burdic



Underwater Acoustic Data Processing:

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

Underwater Acoustic Data Processing Y T Chan, 1989 Underwater Acoustic Signal Processing Douglas A. Abraham, 2019-02-14 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 *Digital Underwater Acoustic Communications* Lufen Xu, Tianzeng Xu, 2016-09-16 *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

Issues in Acoustic Signal — Image Processing and Recognition C. H. Chen, 2012-12-06 The NATO Advanced Research Workshop on Issues in Acoustic Signal Image Processing and Recognition was held August 5-9 1982 at the Cappuccini complex in San Miniato Italy The Workshop was primarily concerned with the underwater acoustic signal processing and seismic signal analysis and a major effort was made to link these topics with pattern recognition image processing and artificial intelligence Major issues and new approaches in these interrelated areas were closely examined in the Workshop In addition to paper presentations three discussion sessions were held on 1 spectral analysis in underwater acoustics 2 seismic wave propagation seismic imaging and migration and seismic inversion and 3 unresolved issues and future directions This Proceedings volume includes most presentations made at the Workshop The publication like the meeting itself is unique in the sense that it provides extensive interactions among the closely related areas stated above Such interactions which usually result in the integration of different systems or approaches are certainly much needed to achieve some performance breakthrough while individual systems or approaches reach their performance limit I am grateful to all participants for their active participation that makes the Workshop very productive and to Dr Lewis J Lloyd and Dr Ralph Goodman for their help to arrange an informative visit to the SACLANT ASW Research Centre for the Workshop participants I am confident that this publication will be equally productive to report important current research results and near future research activity particularly in underwater acoustic signal processing

Underwater Acoustic Digital Signal Processing and Communication Systems Robert Istepanian, Milica Stojanovic, 2013-03-09 Underwater acoustic digital signal processing and communications is an area of applied research that has witnessed major advances over the past decade Rapid developments in this area were made possible by the use of powerful digital signal processors DSPs whose speed computational power and portability allowed efficient implementation of complex signal processing algorithms and experimental demonstration of their performance in a variety of underwater environments The early results served as a motivation for the development of new and improved signal processing methods for underwater applications which today range from classical of autonomous underwater vehicles and sonar signal processing to remote control underwater wireless communications This book presents the diverse areas of underwater acoustic signal processing and communication systems through a collection of contributions from prominent researchers in these areas Their results both new and those published over the past few years have been assembled to provide what we hope is a comprehensive overview of the recent developments in the field The book is intended for a general audience of researchers engineers and students working in the areas of underwater acoustic signal processing It requires the reader to have a basic understanding of the digital signal

processing concepts Each topic is treated from a theoretical perspective followed by practical implementation details We hope that the book can serve both as a study text and an academic reference Fisheries Acoustics Gaurav Shekhar,2025-02-20 Fisheries Acoustics Understanding Aquatic Environments takes you on a captivating journey into the hidden world beneath the waves This comprehensive guide helps readers appreciate the intricate ecosystems thriving in the ocean s depths We offer a unique perspective on the wonders of marine life From vibrant coral reefs to mysterious deep sea trenches each chapter explores different underwater ecosystems revealing the diversity of life forms and the interconnectedness of marine environments Starting with the fundamental principles of marine life we provide essential background knowledge for understanding the complex interactions that shape underwater ecosystems Readers are taken on a virtual dive exploring various underwater habitats and fascinating creatures Stunning photography and detailed illustrations bring the underwater world to life capturing the beauty and diversity of marine life The book explains the crucial role of ocean life in maintaining Earth s biodiversity regulating climate patterns and providing valuable resources Emphasizing conservation efforts we highlight the importance of protecting fragile ecosystems from threats like pollution and overfishing We also explore technological advancements revolutionizing our ability to study ocean depths Whether you re a marine biologist or an ocean enthusiast Fisheries Acoustics Understanding Aquatic Environments offers a wealth of knowledge and inspiration

Advanced Signal Processing Techniques for Underwater Acoustic Communication Networks Chunshan Liu,2011 In this thesis we develop and investigate novel signal processing techniques for underwater acoustic communication networks Underwater acoustic channels differ from radio communication channels in the lower speed of signal propagation richer and often sparse multipath arrivals and more severe Doppler effect Therefore many signal processing techniques developed for radio communications may not work equivalently well for underwater acoustic channels To investigate signal processing techniques in underwater acoustics efficient simulation of signal transmission is required Specifically there is requirement for accurate simulation of doubly selective underwater channels for different acoustic environments In this thesis a low complexity channel simulator has been developed for scenarios with moving transmitter receiver The simulator is based on efficient generation of time varying channel impulse response obtained using interpolation over a set of waymark impulse responses for a relatively small number of sampling points on the transmitter receiver trajectory The waymark impulse responses are generated using an acoustic field computation method which is the most computationally expensive part of the simulator To reduce the trajectory sampling rate and thus to reduce the complexity of the field computation an approach for adjusting the time varying multipath delays has been developed For setting the trajectory sampling interval a simple rule has been proposed based on the waveguide invariant theory To further reduce the simulator complexity local spline interpolation is exploited The developed simulator has been verified by comparing the simulated data with data from real ocean experiments In particular applying simulated data to an OFDM modem shows

similar performance with that obtained from the data of a deep water experiment In communication networks knowledge of positions of communication nodes is important for improving the system performance A multi source localization technique has been proposed based on the matched field MF processing The technique locates the nodes by solving a set of basis pursuit de noising BPDN problems corresponding to a set of source frequencies An efficient technique combining the homotopy approach and coordinate descent search has been developed to solve the BPDN problem Further reduction in the complexity has been achieved by applying a position grid refinement method Verified using simulated data generated by the proposed simulator and data from real experiment the proposed technique outperforms other MF techniques in resolving sources positioned closely to each other tolerance to noise and capability of locating multiple sources To provide reliable localization based on MF techniques accurate knowledge of the underwater acoustic environment is essential However such knowledge is not always available Estimating uncertain environmental parameters can be achieved using MF inversion techniques This requires solving a global optimization problem Several global optimization algorithms have been investigated and an algorithm combining the simulated annealing and downhill simplex method has been applied for estimating the sound speed profile in a deep water scenario Accurate MF localization results have been demonstrated when using the estimated sound speed profile A very important task of communication receivers is accurate channel estimation The knowledge of node positions and the environment can be exploited for enhancing the channel estimation accuracy and reducing the estimation complexity This knowledge can be used to define the structure of the channel impulse response such as the multipath spread and the sparsity A channel estimator exploiting the channel sparsity estimated from the node positions has been proposed and investigated The sparse taps of the channel impulse response are identified by solving a BPDN problem The estimator employs an iterative tap by tap processing and uses local splines to interpolate the time varying tap coefficients This allows reduction in the complexity and memory requirement whereas providing a high estimation accuracy

The Shock and Vibration Digest ,1990 *The Militarily Critical Technologies List* ,1992 **Digital Sonar Design in Underwater Acoustics** Qihu Li,2012-03-05 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 academician of the Chinese Academy of Sciences

Technical Abstract Bulletin ,
Underwater Acoustic System Analysis William S. Burdic,1984 Historical background Acoustic waves in a homogeneous

medium Acoustic transducers Reflection transmission and refraction Sound transmission in the ocean Fourier methods Discrete fourier methods Correlation and correlation functions Random processes Ambiente noise in the ocean Spatial filtering beamforming Acoustic characteristics of targets Statistical basis for performance analysis System performance analysis examples **Acoustic Signal Processing for Ocean Exploration** J.M.F Moura, Isabel M.G. Lourtie, 2012-12-06 Acoustic Signal Processing for Ocean Explortion 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 **Time-varying Image Processing and Moving Object Recognition, 2** Vito Cappellini, 1990 The new specific area of Time Varying Image Processing and Moving Object Recognition is attracting increasing interest This new area is contributing to impressive advances in several fields such as communications radar sonar systems remote sensing biomedicine moving vehicle recognition tracking traffic monitoring automatic inspection and robotics This volume provides an authoritative and timely review on the latest scientific and technical advances in this area New digital image processing and recognition methods implementation techniques and advanced applications are presented New approaches for solving 3 D problems are described with particular reference to the recognition and tracking of moving objects The contributions in this volume written by internationally renowned experts will provide both a stimulus for future research in this field as well as useful reference material for many years to come

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

Maritime Information Review ,1998 **Statistical and Spectral Analysis of Underwater Acoustic Data** Luciano G. Dominijanni,1975 **Extracting Meaning from Complex Data** ,1991 **Oceanic Abstracts with Indexes** ,1986

Embracing the Beat of Appearance: An Psychological Symphony within **Underwater Acoustic Data Processing**

In a global taken by screens and the ceaseless chatter of instantaneous interaction, the melodic elegance and mental symphony produced by the published term usually disappear in to the background, eclipsed by the persistent noise and disturbances that permeate our lives. Nevertheless, situated within the pages of **Underwater Acoustic Data Processing** a stunning fictional value overflowing with raw emotions, lies an immersive symphony waiting to be embraced. Constructed by an outstanding composer of language, this interesting masterpiece conducts readers on a mental journey, well unraveling the concealed tunes and profound impact resonating within each cautiously crafted phrase. Within the depths of the touching assessment, we will explore the book is main harmonies, analyze their enthralling writing design, and submit ourselves to the profound resonance that echoes in the depths of readers souls.

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Underwater Acoustic Data Processing Introduction

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