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Sound Propagation In Stratified Fluids:

Sound Propagation in Stratified Fluids Calvin H. Wilcox, 2012-12-06 Stratified fluids whose densities sound speeds and other parameters are functions of a single depth coordinate occur widely in nature Indeed the earth's gravitational field imposes a stratification on its atmosphere oceans and lakes It is well known that their stratification has a profound effect on the propagation of sound in these fluids The most striking effect is probably the occurrence of acoustic ducts due to minima of the sound speed that can trap sound waves and cause them to propagate horizontally The reflection transmission and distortion of sonar signals by acoustic ducts is important in interpreting sonar echoes Signal scattering by layers of microscopic marine organisms is important to both sonar engineers and marine biologists Again reflection of signals from bottom sediment layers overlying a penetrable bottom are of interest both as sources of unwanted echoes and in the acoustic probing of such layers Many other examples could be given The purpose of this monograph is to develop from first principles a theory of sound propagation in stratified fluids whose densities and sound speeds are essentially arbitrary functions of the depth In physical terms the propagation of both time harmonic and transient fields is analyzed The corresponding mathematical model leads to the study of boundary value problems for a scalar wave equation whose coefficients contain the prescribed density and sound speed functions

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Spectral Analysis of Sound Propagation in Stratified Fluids Calvin H. Wilcox, 1980 This paper presents a spectral analysis of the acoustic fields in stationary plane stratified fluids whose densities and sound speeds are functions of the depth The analysis is based on families of normal mode fields that have simple physical interpretations The acoustic field in such a fluid may be described by an acoustic potential or by the excess pressure

Manipulation of Sound Properties by Acoustic Metasurface and

Metastructure Jiajun Zhao, 2016-08-06 This thesis focuses on the manipulation of sound properties by artificial materials It elaborates on the fundamental design of acoustic metasurfaces and metastructures as the extension of metamaterials and their functionality in the manipulation of sound properties A broad and comprehensive guideline of designing acoustic metasurfaces and metastructures is also provided Based on the proposed subwavelength metasurfaces and the metastructures with a simplified layout multiple potential applications are demonstrated This thesis will appeal to acoustic engineers and researchers who are interested in designing acoustic artificial structures

Transient Acoustic Wave Propagation in Stratified Fluids Calvin H. Wilcox, UTAH UNIV SALT LAKE CITY DEPT OF MATHEMATICS., 1981

Transient acoustic wave propagation is analyzed for the case of plane stratified fluids having density $\rho(y)$ and sound speed $c(y)$ at depth y For infinite fluids it is assumed that the in general discontinuous functions $\rho(y)$ and $c(y)$ are uniformly positive and bounded and satisfy $\lim_{y \rightarrow \pm\infty} \rho(y) = \rho_0$ or C or y to the α power $\lim_{y \rightarrow \pm\infty} c(y) = c_0$ or C or y to the α power for $\alpha > 0$ where $\alpha \geq 2$ Semi infinite and finite layers are also treated The acoustic potential is a solution of the wave equation $\frac{\partial^2 u}{\partial t^2} - c^2(y) \frac{\partial}{\partial y} \left(\frac{1}{\rho(y)} \frac{\partial u}{\partial y} \right) = f(x, y)$ where x_1, x_2 are horizontal coordinates and $f(x, y)$ characterizes the wave sources The principal results of the analysis show that u is the sum of a free component which behaves like a diverging spherical wave for large t and a guided component which is approximately localized in regions $y \approx y_j$

Scientific and Technical Aerospace Reports, 1991

Wave Packets and Their Bifurcations in Geophysical Fluid Dynamics Huijun Yang, 1991 The material in this book is based predominantly on my recent work It is the first monograph on the subject though some support material may overlap other monographs The investigation of wave packets and their bifurcations is very interesting and useful theoretically and in practice not only in geophysical fluid dynamics which is the field to which the theory is being applied here but also in other fields in mathematics and the natural sciences I hope that the applied mathematician will find reading this book worthwhile especially the material on the behavior of highly nonlinear dynamic systems However it is my belief that applying the concepts and methods developed here to other fields will be both interesting and constructive since there are numerous phenomena in other areas of physics that share the characteristics of those in geophysical fluid dynamics The theory developed here provides an effective tool to investigate the structure and the structural changes of dynamic systems in physics Applications of the theory in geophysical fluid dynamics are an example of its usefulness and effectiveness Some of the results presented here give us more insight into the nature of geophysical fluids Moreover the material is presented systematically and developmentally Necessary basic knowledge is provided to make the book more readable for graduate students and researchers in such fields as applied mathematics geophysical fluid dynamics atmospheric sciences and physical oceanography

Computational Acoustics and Its Environmental Applications C. A. Brebbia, 1995 The need for accurate prediction of noise has resulted in a growing awareness of the power of computer codes to monitor acoustic problems which are of primary importance in

industry architecture and the environment It is only now that their effects can accurately be predicted using computers and this provides a unique tool for noise control and reduction Reviews in Partial Differential Equations, 1980-86, as Printed in Mathematical Reviews ,1988 **Oceanic Abstracts with Indexes** ,1980 *Construction of Approximations to Acoustic Green's Functions for Nonhomogeneous Oceans Using Transmutation* Robert P. Gilbert,David H. Wood,Yongzhi Xu,1988 Revue Roumaine de Mathématiques Pures Et Appliquées ,2004 Physics Briefs ,1994 **NASA Conference Publication** ,1990 **Publicationes mathematicae** Kossuth Lajos Tudományegyetem. Matematikai Intézet,1985 *Russian Journal of Mathematical Physics* ,2007 **R & D Abstracts** Technology Reports Centre (Great Britain),1981 **Government Reports Announcements & Index** ,1991 **The Theory of Sound** John William Strutt Baron Rayleigh,1896 **Geoacoustic Inversion in Laterally Varying Shallow-water Environments Using High-resolution Wavenumber Estimation** Kyle M. Becker,2002

Cont The estimator was also applied to determine wavenumbers for synthetic data where the water column sound speed contained temporal variations due to the presence of internal waves It was shown that reliable estimates of horizontal wavenumbers could be obtained that are consistent with the boundary conditions of the waveguide The Modal Mapping Experiment MOMAX an experimental method for measuring the full spatial variability of a propagating sound field and its corresponding modal content in two dimensions is also discussed The AR estimator is applied to extract modal content from the real data and interpreted with respect to source receiver motion and geometry For a moving source it is shown that the wavenumber content is Doppler shifted A method is then described that allows the direct measure of modal group velocities from Doppler shifted wavenumber spectra Finally numerical studies are presented addressing the practical issues associated with using MOMAX type data in the exact inversion method of Gelfand Levitan

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