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Calvin H. Wilcox

Sound Propagation in Stratified Fluids



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Sound Propagation In Stratified Fluids

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Sound Propagation In Stratified Fluids:

Sound Propagation in Stratified Fluids Calvin H Wilcox, 1984-04-01 *Sound Propagation in Stratified Fluids* Calvin Hayden Wilcox, 1984 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 *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 $\rho(y)$ $c(y)$ are uniformly positive and bounded and satisfy $\lim_{y \rightarrow \pm\infty} \rho(y) = \rho_0$ or C or y to the α power $\lim_{y \rightarrow \pm\infty} c(y) = C$ or y to the α power for $y \geq 0$ where $\alpha \geq 2$ Semi infinite and finite layers are also treated The acoustic potential is a solution of the wave equation $\Delta u = -\frac{1}{c^2} \frac{\partial}{\partial t} \left(\frac{1}{\rho} \frac{\partial u}{\partial t} \right)$ where x_1, x_2 are horizontal coordinates and $f(t, x)$ 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 $y \leq y_0$ *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 **Wave Packets and Their Bifurcations in Geophysical Fluid Dynamics** Huijun Yang, 2013-06-29 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.

Scattering Theory for Hyperbolic Operators V. Petkov, 1989-11-20

Scattering Theory for dissipative and time dependent systems has been intensively studied in the last fifteen years. The results in this field based on various tools and techniques may be found in many published papers. This monograph presents an approach which can be applied to spaces of both even and odd dimension. The ideas on which the approach is based are connected with the RAGE type theorem with Enns decomposition of the phase space and with a time dependent proof of the existence of the operator W which exploits the decay of the local energy of the perturbed and free systems. Some inverse scattering problems for time dependent potentials and moving obstacles with an arbitrary geometry are also treated in the book.

Theory of Multicomponent Fluids Donald A. Drew, Stephen L. Passman, 2006-05-10

In this book we give a rational treatment of multicomponent materials as interacting continua. We offer two derivations of the equations of motion for the interacting continua: one which uses the concepts of continua for the components and one which applies an averaging operation to the continuum equations for each component. Arguments are given for constitutive equations appropriate for dispersed multicomponent flows. The forms of the constitutive equations are derived from the principles of continuum mechanics applied to the components and their interactions. The solutions of problems of hydromechanics of ordinary continua are used as motivation for the forms of certain constitutive equations in multicomponent materials. The balance of the book is devoted to the study of problems of hydrodynamics of multicomponent flows. Many materials are homogeneous in the sense that each part of the material has the same response to a given set of stimuli as all of the other parts. An example of such a material is pure water. Formulation of equations describing the behavior of homogeneous materials is well understood and is described in numerous standard textbooks. Many other materials, both manufactured and occurring in nature, are not homogeneous. Such materials are often given names such as mixtures or composites.

Mathematical Theory of Incompressible Nonviscous Fluids Carlo Marchioro, Mario Pulvirenti, 2012-12-06

Fluid dynamics is an ancient science, incredibly alive today. Modern technology and new needs require a deeper knowledge of the behavior of real fluids, and new discoveries or steps forward pose quite often challenging and difficult new mathematical problems. In this framework, a special role is played by incompressible nonviscous, sometimes called perfect, flows. This is a mathematical model consisting essentially of an evolution equation, the Euler equation, for the velocity field of fluids. Such an equation, which is nothing other than the Newton laws plus some additional structural hypotheses, was discovered by Euler in 1755 and although it is more than two centuries old, many fundamental questions concerning its solutions are still open. In particular, it is not known whether the solutions for reasonably general initial conditions develop singularities in a finite time, and very little is known about the long term

behavior of smooth solutions These and other basic problems are still open and this is one of the reasons why the mathematical theory of perfect flows is far from being completed Incompressible flows have been attacked by many distinguished mathematicians with a large variety of mathematical techniques so that today this field constitutes a very rich and stimulating part of applied mathematics

New Directions in Mathematical Fluid Mechanics Andrei V. Fursikov, Giovanni P. Galdi, Vladislav V. Pukhnachev, 2010-01-11 On November 3 2005 Alexander Vasil evich Kazhikhov left this world untimely and unexpectedly He was one of the most influential mathematicians in the mechanics of fluids and will be remembered for his outstanding results that had and still have a considerable significance in the field Among his many achievements were recall that he was the founder of the modern mathematical theory of the Navier Stokes equations describing one and two dimensional motions of a viscous compressible and heat conducting gas A brief account of Professor Kazhikhov's contributions to science is provided in the following article Scientific portrait of Alexander Vasil evich Kazhikhov This volume is meant to be an expression of high regard to his memory from most of his friends and his colleagues In particular it collects a selection of papers that represent the latest progress in a number of new important directions of Mathematical Physics mainly of Mathematical Fluid Mechanics These papers are written by world renowned specialists Most of them were friends students or colleagues of Professor Kazhikhov who either worked with him directly or met him many times in official scientific meetings where they had the opportunity of discussing problems of common interest

Fluid Dynamics of Viscoelastic Liquids Daniel D. Joseph, 2013-11-27 This book is about two special topics in rheological fluid mechanics the elasticity of liquids and asymptotic theories of constitutive models The major emphasis of the book is on the mathematical and physical consequences of the elasticity of liquids seventeen of twenty chapters are devoted to this Constitutive models which are instantaneously elastic can lead to some hyperbolicity in the dynamics of flow waves of vorticity into rest known as shear waves to shock waves of vorticity or velocity to steady flows of transonic type or to short wave instabilities which lead to ill posed problems Other kinds of models with small Newtonian viscosities give rise to perturbed instantaneous elasticity associated with smoothing of discontinuities as in gas dynamics There is no doubt that liquids will respond like elastic solids to impulses which are very rapid compared to the time it takes for the molecular order associated with short range forces in the liquid to relax After this all liquids look viscous with signals propagating by diffusion rather than by waves For small molecules this time of relaxation is estimated as 10^{-13} to 10^{-10} seconds depending on the fluids Waves associated with such liquids move with speeds of 10^5 cm/s or even faster For engineering applications the instantaneous elasticity of these fluids is of little interest the practical dynamics is governed by diffusion say by the Navier Stokes equations On the other hand there are other liquids which are known to have much longer times of relaxation

Integral Manifolds and Inertial Manifolds for Dissipative Partial Differential Equations P. Constantin, C. Foias, B. Nicolaenko, R. Temam, 2012-12-06 This work was initiated in the summer of 1985 while all of the authors were at the Center of Nonlinear Studies of the Los Alamos

National Laboratory it was then continued and polished while the authors were at Indiana University at the University of Paris Sud Orsay and again at Los Alamos in 1986 and 1987 Our aim was to present a direct geometric approach in the theory of inertial manifolds global analogs of the unstable center manifolds for dissipative partial differential equations This approach based on Cauchy integral manifolds for which the solutions of the partial differential equations are the generating characteristic curves has the advantage that it provides a sound basis for numerical Galerkin schemes obtained by approximating the inertial manifold The work is self contained and the prerequisites are at the level of a graduate student The theoretical part of the work is developed in Chapters 2-14 while in Chapters 15-19 we apply the theory to several remarkable partial differential equations

Hysteresis and Phase Transitions Martin Brokate, Jürgen Sprekels, 2012-12-06 Hysteresis is an exciting and mathematically challenging phenomenon that occurs in rather different situations it can be a byproduct of fundamental physical mechanisms such as phase transitions or the consequence of a degradation or imperfection like the play in a mechanical system or it is built deliberately into a system in order to monitor its behaviour as in the case of the heat control via thermostats The delicate interplay between memory effects and the occurrence of hysteresis loops has the effect that hysteresis is a genuinely nonlinear phenomenon which is usually non smooth and thus not easy to treat mathematically Hence it was only in the early seventies that the group of Russian scientists around M A Krasnoselskii initiated a systematic mathematical investigation of the phenomenon of hysteresis which culminated in the fundamental monograph Krasnoselskii Pokrovskii 1983 In the meantime many mathematicians have contributed to the mathematical theory and the important monographs of I Mayergoyz 1991 and A Visintin 1994a have appeared We came into contact with the notion of hysteresis around the year 1980

Matched Asymptotic Expansions P.A. Lagerstrom, 2013-03-09 Content and Aims of this Book Earlier drafts of the manuscript of this book James A. Boyce was then coauthor contained discussions of many methods and examples of singular perturbation problems The ambitious plans of covering a large number of topics were later abandoned in favor of the present goal a thorough discussion of selected ideas and techniques used in the method of matched asymptotic expansions Thus many problems and methods are not covered here the method of averaging and the related method of multiple scales are mentioned mainly to give reasons why they are not discussed further Examples which required too sophisticated and involved calculations or advanced knowledge of a special field are not treated for instance to the author's regret some very interesting applications to fluid mechanics had to be omitted for this reason Artificial mathematical examples introduced to show some exotic or unexpected behavior are omitted except when they are analytically simple and are needed to illustrate mathematical phenomena important for realistic problems Problems of numerical analysis are not discussed

Invariant Manifolds and Fibrations for Perturbed Nonlinear Schrödinger Equations Charles Li, Stephen Wiggins, 2012-12-06 This book presents a development of invariant manifold theory for a specific canonical nonlinear wave system the perturbed nonlinear Schrödinger equation

The main results fall into two parts The first part is concerned with the persistence and smoothness of locally invariant manifolds The second part is concerned with fibrations of the stable and unstable manifolds of inflowing and overflowing invariant manifolds The central technique for proving these results is Hadamard's graph transform method generalized to an infinite dimensional setting However our setting is somewhat different than other approaches to infinite dimensional invariant manifolds since for conservative wave equations many of the interesting invariant manifolds are infinite dimensional and noncompact The style of the book is that of providing very detailed proofs of theorems for a specific infinite dimensional dynamical system the perturbed nonlinear Schrödinger equation The book is organized as follows Chapter one gives an introduction which surveys the state of the art of invariant manifold theory for infinite dimensional dynamical systems Chapter two develops the general setup for the perturbed nonlinear Schrödinger equation Chapter three gives the proofs of the main results on persistence and smoothness of invariant manifolds Chapter four gives the proofs of the main results on persistence and smoothness of fibrations of invariant manifolds This book is an outgrowth of our work over the past nine years concerning homoclinic chaos in the perturbed nonlinear Schrödinger equation The theorems in this book provide key building blocks for much of that work

Technical Abstract Bulletin, 1980 **Lectures on Viscoelasticity**
Theory A.C. Pipkin, 2012-12-06 This book contains notes for a one semester course on viscoelasticity given in the Division of Applied Mathematics at Brown University The course serves as an introduction to viscoelasticity and as a workout in the use of various standard mathematical methods The reader will soon find that he needs to do some work on the side to fill in details that are omitted from the text These are notes not a completely detailed explanation Furthermore much of the content of the course is in the problems assigned for solution by the student The reader who does not at least try to solve a good many of the problems is likely to miss most of the point Much that is known about viscoelasticity is not discussed in these notes and references to original sources are usually not given so it will be difficult or impossible to use this book as a reference for looking things up Readers wanting something more like a treatise should see Ferry's *Viscoelastic Properties of Polymers* Lodge's *Elastic Liquids* the volumes edited by Eirich on *Rheology* or any issue of the *Transactions of the Society of Rheology* These works emphasize physical aspects of the subject On the mathematical side Gurtin and Sternberg's long paper *On the Linear Theory of Viscoelasticity* ARMA II 291 1962 remains the best reference for proofs of theorems

Inverse Acoustic and Electromagnetic Scattering Theory David Colton, Rainer Kress, 2013-03-09 In the five years since the first edition of this book appeared the field of inverse scattering theory has continued to grow and flourish Hence when the opportunity for a second edition presented itself we were pleased to have the possibility of updating our monograph to take into account recent developments in the area As in the first edition we have been motivated by our own view of inverse scattering and have not attempted to include all of the many new directions in the field However we feel that this new edition represents a state of the art overview of the basic elements of the mathematical theory of acoustic and electromagnetic

inverse scattering In addition to making minor corrections and additional comments in the text and updating the references we have added new sections on Newton's method for solving the inverse obstacle problem Section 5.3 the spectral theory of the far field operator Section 8.4 a proof of the uniqueness of the solution to the inverse medium problem for acoustic waves Section 10.2 and a method for determining the support of an inhomogeneous medium from far field data by solving a linear integral equation of the first kind Section 10.7 We hope that this second edition will attract new readers to the beautiful and intriguing field of inverse scattering *Scientific and Technical Aerospace Reports*, 1991 **Singular Limits in**

Thermodynamics of Viscous Fluids Eduard Feireisl, Antonín Novotný, 2017-11-24 This book is about singular limits of systems of partial differential equations governing the motion of thermally conducting compressible viscous fluids The main aim is to provide mathematically rigorous arguments how to get from the compressible Navier-Stokes-Fourier system several less complex systems of partial differential equations used e.g. in meteorology or astrophysics However the book contains also a detailed introduction to the modelling in mechanics and thermodynamics of fluids from the viewpoint of continuum physics The book is very interesting and important It can be recommended not only to specialists in the field but it can also be used for doctoral students and young researchers who want to start to work in the mathematical theory of compressible fluids and their asymptotic limits Milan Pokorný zbMATH This book is of the highest quality from every point of view It presents in a unified way recent research material of fundamental importance It is self-contained thanks to Chapter 3 existence theory and to the appendices It is extremely well organized and very well written It is a landmark for researchers in mathematical fluid dynamics especially those interested in the physical meaning of the equations and statements Denis Serre MathSciNet

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