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Book Review: Wave packets and their bifurcations in ...

In physics, a wave packet is a short "burst" or "envelope" of localized wave action that travels as a unit. A wave packet can be analyzed into, or can be synthesized from, an infinite set of component sinusoidal waves of different wavenumbers, with phases and amplitudes such that they interfere constructively only over a small region of space, and destructively elsewhere. Each component wave function, and hence the wave packet, are solutions of a wave equation. Depending on the wave equation, th

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The equations determining the structure and its change are addressed in Section 7.4. Integral properties of this model are presented in Section 7.5. Sections 7.6 and 7.7 discuss the structures of wave packets and their changes on the zonal and meridional basic flow, respectively.

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The book includes all the subject matter covered in a typical undergraduate course in engineering thermodynamics. It includes a series of worked examples in each chapter, carefully chosen to expose students to diverse applications of engineering thermodynamics. Each worked example is designed to be representative of a class of physical problems. At the end of each chapter, there are an additional 10 to 15 problems for which numerical answers are provided.

Most physical systems lose or gain stability through bifurcation behavior. This book explains a series of experimentally found bifurcation phenomena by means of the methods of static bifurcation theory.

This book has been written in a frankly partisian spirit-we believe that singularity theory offers an extremely useful approach to bifurcation prob lems and we hope to convert the reader to this view. In this preface we will discuss what we feel are the strengths of the singularity theory approach. This discussion then Ieads naturally into a discussion of the contents of the book and the prerequisites for reading it. Let us emphasize that our principal contribution in this area has been to apply pre-existing techniques from singularity theory, especially unfolding theory and classification theory, to bifurcation problems. Many ofthe ideas in this part of singularity theory were originally proposed by Rene Thom; the subject was then developed rigorously by John Matherand extended by V. I. Arnold. In applying this material to bifurcation problems, we were greatly encouraged by how weil the mathematical ideas of singularity theory meshed with the questions addressed by bifurcation theory. Concerning our title, Singularities and Groups in Bifurcation Theory, it should be mentioned that the present text is the first volume in a two-volume sequence. In this volume our emphasis is on singularity theory, with group theory playing a subordinate role. In Volume II the emphasis will be more balanced. Having made these remarks, Iet us set the context for the discussion of the strengths of the singularity theory approach to bifurcation. As we use the term, bifurcation theory is the study of equations with multiple solutions.

A solid basis for anyone studying the dynamical systems theory, providing the necessary understanding of the approaches, methods, results and terminology used in the modern applied-mathematics literature. Covering the basic topics in the field, the text can be used in a course on nonlinear dynamical systems or system theory. Special attention is given to efficient numerical implementations of the developed techniques, illustrated by several examples from recent research papers. A moderate mathematical background is assumed, and, whenever possible, only elementary mathematical tools are used, making this book suitable for advanced undergraduate or graduate students in applied mathematics, as well as for researchers in other disciplines who use dynamical systems as model tools in their studies.

An up-to-date and unified treatment of bifurcation theory for variational inequalities in reflexive spaces and the use of the theory in a variety of applications, such as: obstacle problems from elasticity theory, unilateral problems; torsion problems; equations from fluid mechanics and quasilinear elliptic partial differential equations. The tools employed are those of modern nonlinear analysis. Accessible to graduate students and researchers who work in nonlinear analysis, nonlinear partial differential equations, and additional research disciplines that use nonlinear mathematics.

A unique and detailed account of all important relations in the analytic theory of determinants, from the classical work of Laplace, Cauchy and Jacobi to the latest 20th century developments. The first five chapters are purely mathematical in nature and make extensive use of the column vector notation and scaled cofactors. They contain a number of important relations involving derivatives which prove beyond a doubt that the theory of determinants has emerged from the confines of classical algebra into the brighter world of analysis. Chapter 6 is devoted to the verifications of the known determinantal solutions of several nonlinear equations which arise in three branches of mathematical physics, namely lattice, soliton and relativity theory. The solutions are verified by applying theorems established in earlier chapters, and the book ends with an extensive bibliography and index. Several contributions have never been published before. Indispensable for mathematicians, physicists and engineers wishing to become acquainted with this topic.

The propagation of acoustic and electromagnetic waves in stratified media is a subject that has profound implications in many areas of applied physics and in engineering, just to mention a few, in ocean acoustics, integrated optics, and wave guides. See for example Tolstoy and Clay 1966, Marcuse 1974, and Brekhovskikh 1980. As is well known, stratified media, that is to say media whose physical properties depend on a single coordinate, can produce guided waves that propagate in directions orthogonal to that of stratification, in addition to the free waves that propagate as in homogeneous media. When the stratified media are perturbed, that is to say when locally the physical properties of the media depend upon all of the coordinates, the free and guided waves are no longer solutions to the appropriate wave equations, and this leads to a rich pattern of wave propagation that involves the scattering of the free and guided waves among each other, and with the perturbation. These phenomena have many implications in applied physics and engineering, such as in the transmission and reflexion of guided waves by the perturbation, interference between guided waves, and energy losses in open wave guides due to radiation. The subject matter of this monograph is the study of these phenomena.

Filling the gap between the mathematical literature and applications to domains, the authors have chosen to address the problem of wave collapse by several methods ranging from rigorous mathematical analysis to formal aymptotic expansions and numerical simulations.