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EQUATIONS OF MATHEMATICAL PHYSICS

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PARTIAL DIFFERENTIAL EQUATIONS I

BASIC THEORY

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are then applied to the treatment of basic problems in linear PDE, including the Laplace equation, heat equation, and wave equation, as well as more general elliptic, parabolic, and hyperbolic equations.The book is targeted at graduate students in mathematics and at professional mathematicians with an interest in partial differential equations, mathematical physics, differential geometry, harmonic analysis, and complex analysis.

DIFFERENTIAL EQUATIONS ON MANIFOLDS AND MATHEMATICAL PHYSICS

DEDICATED TO THE MEMORY OF BORIS STERNIN

Birkhäuser **This is a volume originating from the Conference on Partial Differential Equations and Applications, which was held in Moscow in November 2018 in memory of professor Boris Sternin and attracted more than a hundred participants from eighteen countries. The conference was mainly dedicated to partial differential equations on manifolds and their applications in mathematical physics, geometry, topology, and complex analysis. The volume contains selected contributions by leading experts in these fields and presents the current state of the art in several areas of PDE. It will be of interest to researchers and graduate students specializing in partial differential equations, mathematical physics, topology, geometry, and their applications. The readers will benefit from the interplay between these various areas of mathematics.**

PARTIAL DIFFERENTIAL EQUATIONS AND MATHEMATICAL PHYSICS

IN MEMORY OF JEAN LERAY

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partial differential operators, * The hypoellipticity of second order operators, * Differential forms and Hodge theory on analytic spaces, * Subelliptic operators and sub- Riemannian geometry. Contributors: V. Ancona, R. Beals, A. Bove, R. Camales, Y. Choquet- Bruhat, F. Colombini, M. De Gosson, S. De Gosson, M. Di Flaviano, B. Gaveau, D. Gourdin, P. Greiner, Y. Hamada, K. Kajitani, M. Mechab, K. Mizohata, V. Moncrief, N. Nakazawa, T. Nishitani, Y. Ohya, T. Okaji, S. Ouchi, S. Spagnolo, J. Vaillant, C. Wagschal, S. Wakabayashi The book is suitable as a reference text for graduate students and active researchers.

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BLOW-UP IN NONLINEAR EQUATIONS OF MATHEMATICAL PHYSICS

THEORY AND METHODS

Walter de Gruyter GmbH & Co KG **The present book carefully studies the blow-up phenomenon of solutions to partial differential equations, including many equations of mathematical physics. The included material is based on lectures read by the authors at the Lomonosov Moscow State University, and the book is addressed to a wide range of researchers and graduate students working in nonlinear partial differential equations, nonlinear functional analysis, and mathematical physics. Contents Nonlinear capacity method of S. I. Pokhozhaev Method of self-similar solutions of V. A. Galaktionov Method of test functions in combination with method of nonlinear capacity Energy method of H. A. Levine Energy method of G. Todorova Energy method of S. I. Pokhozhaev Energy method of V. K. Kalantarov and O. A. Ladyzhenskaya Energy method of M. O. Korpusov and A. G. Sveshnikov Nonlinear Schrödinger equation Variational method of L. E. Payne and D. H. Sattinger Breaking of solutions of wave equations Auxiliary and additional results**

PARTIAL DIFFERENTIAL EQUATIONS IN PHYSICS

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PARTIAL DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS

LECTURE NOTES IN APPLIED DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS

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PARTIAL DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS

A COLLECTION OF PARTIAL DIFFERENTIAL EQUATIONS FROM MATHEMATICAL PHYSICS

MATHEMATICAL PHYSICS WITH PARTIAL DIFFERENTIAL EQUATIONS

Academic Press **Mathematical Physics with Partial Differential Equations, Second Edition, is designed for upper division undergraduate and beginning graduate students taking mathematical physics taught out by math departments. The new edition is based on the success of the first, with a continuing focus on clear presentation, detailed examples, mathematical rigor and a careful selection of topics. It presents the familiar classical topics and methods of mathematical physics with more extensive coverage of the three most important partial differential equations in the field of mathematical physics—the heat equation, the wave equation and Laplace's equation. The book presents the most common techniques of solving these equations, and their derivations are developed in detail for a deeper understanding of mathematical applications. Unlike many physics-leaning mathematical physics books on the market, this work is heavily rooted in math, making the book more appealing for students wanting to progress in mathematical physics, with particularly deep coverage of Green's functions, the Fourier transform, and the Laplace transform. A salient characteristic is the focus on fewer topics but at a far more rigorous level of detail than comparable undergraduate-facing textbooks. The depth of some of these topics, such as the Dirac-delta distribution, is not matched elsewhere. New features in this edition include: novel and illustrative examples from physics including the 1-dimensional quantum mechanical oscillator, the hydrogen atom and the rigid rotor model; chapter-length discussion of relevant functions, including the Hermite polynomials, Legendre polynomials, Laguerre polynomials and Bessel functions; and all-new focus on complex examples only solvable by multiple methods. Introduces and evaluates numerous physical and engineering concepts in a rigorous mathematical framework Provides extremely detailed mathematical derivations and solutions with extensive proofs and weighting for application potential Explores an array of detailed examples from physics that give direct application to rigorous mathematics Offers instructors useful resources for teaching, including an illustrated instructor's manual, PowerPoint presentations in each chapter and a solutions manual**

PARTIAL DIFFERENTIAL EQUATIONS V

ASYMPTOTIC METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

Springer Science & Business Media **In this paper we shall discuss the construction of formal short-wave asymp totic solutions of problems of mathematical physics. The topic is very broad. It can somewhat conveniently be divided into three parts: 1. Finding the short-wave asymptotics of a rather narrow class of problems, which admit a solution in an explicit form, via formulas that represent this solution. 2. Finding formal asymptotic solutions of equations that describe wave processes by basing them on some ansatz or other. We explain what 2 means. Giving an ansatz is knowing how to give a formula for the desired asymptotic solution in the form of a series or some expression containing a series, where the analytic nature of the terms of these series is indicated up to functions and coefficients that are undetermined at the first stage of consideration. The second stage is to determine these functions and coefficients using a direct substitution of the ansatz in the equation, the boundary conditions and the initial conditions. Sometimes it is necessary to use different ansiitze in different domains, and in the overlapping parts of these domains the formal asymptotic solutions must be asymptotically equivalent (the method of matched asymptotic expansions). The basis for success in the search for formal asymptotic solutions is a suitable choice of ansiitze. The study of the asymptotics of explicit solutions of special model problems allows us to "surmise" what the correct ansiitze are for the general solution.**

PHYSICAL MATHEMATICS AND NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

CRC Press **This volume consists of the proceedings of the conference on Physical Mathematics and Nonlinear Partial Differential Equations held at West Virginia University in Morgantown. It describes some work dealing with weak limits of solutions to nonlinear systems of partial differential equations.**

DEVELOPMENTS IN PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS TO MATHEMATICAL PHYSICS

Springer Science & Business Media **During the days 14-18 of October 1991, we had the pleasure of attending a most interesting Conference on New Developments in Partial Differential Equations and Applications to Mathematical Physics in Ferrarra. The Conference was organized within the Scientific Program celebrating the six hundredth birthday of the University of Ferrarra and, after the many stimulating lectures and fruitful discussions, we may certainly**

conclude, together with the numerous participants, that it has represented a big success. The Conference would not have been possible without the financial support of several sources. In this respect, we are particularly grateful to the Comitato Organizzatore del VI Centenario, the University of Ferrarra in the Office of the Rector, Professor Antonio Rossi, the Consiglio Nationale delle Ricerche, and the Department of Mathematics of the University of Ferrarra. We should like to thank all of the partlClpants and the speakers, and we are especially grateful to those who have contributed to the present volume. G. Buttazzo, University of Pisa G.P. Galdi, University of Ferrarra L. Zanghirati, University of Ferrarra Ferrarra, May 11 th, 1992 v CONTENTS INVITED LECTURES Liapunov Functionals and Qualitative Behaviour of the Solution to the Nonlinear Enskog Equation ...

EQUATIONS IN MATHEMATICAL PHYSICS

A PRACTICAL COURSE

Springer Science & Business Media **Many physical processes in fields such as mechanics, thermodynamics, electricity, magnetism or optics are described by means of partial differential equations. The aim of the present book is to demontstrate the basic methods for solving the classical linear problems in mathematical physics of elliptic, parabolic and hyperbolic type. In particular, the methods of conformal mappings, Fourier analysis and Green`s functions are considered, as well as the perturbation method and integral transformation method, among others. Every chapter contains concrete examples with a detailed analysis of their solution.The book is intended as a textbook for students in mathematical physics, but will also serve as a handbook for scientists and engineers.**

NON-LINEAR PARTIAL DIFFERENTIAL EQUATIONS, MATHEMATICAL PHYSICS, AND STOCHASTIC ANALYSIS

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American Mathematical Soc. **This book is dedicated to fundamentals of a new theory, which is an analog of affine algebraic geometry for (nonlinear) partial differential equations. This theory grew up from the classical geometry of PDE's originated by S. Lie and his followers by incorporating some nonclassical ideas from the theory of integrable systems, the formal theory of PDE's in its modern cohomological form given by D. Spencer and H. Goldschmidt and**

differential calculus over commutative algebras (Primary Calculus). The main result of this synthesis is Secondary Calculus on diffieties, new geometrical objects which are analogs of algebraic varieties in the context of (nonlinear) PDE's. Secondary Calculus surprisingly reveals a deep cohomological nature of the general theory of PDE's and indicates new directions of its further progress. Recent developments in quantum field theory showed Secondary Calculus to be its natural language, promising a nonperturbative formulation of the theory. In addition to PDE's themselves, the author describes existing and potential applications of Secondary Calculus ranging from algebraic geometry to field theory, classical and quantum, including areas such as characteristic classes, differential invariants, theory of geometric structures, variational calculus, control theory, etc. This book, focused mainly on theoretical aspects, forms a natural dipole with Symmetries and Conservation Laws for Differential Equations of Mathematical Physics, Volume 182 in this same series, Translations of Mathematical Monographs, and shows the theory "in action".