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**Differential Equations  
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This book tries to point out the mathematical importance of the Partial Differential Equations of First Order (PDEFO) in Physics and Applied Sciences. The intention is to provide mathematicians with a wide view of the applications of this branch in physics, and to give physicists and applied scientists a powerful tool for solving some problems appearing in Classical Mechanics, Quantum Mechanics, Optics, and General Relativity. This book is intended for senior or first year graduate students in mathematics, physics, or

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engineering curricula. This book is unique in the sense that it covers the applications of PDEFO in several branches of applied mathematics, and fills the theoretical gap between the formal mathematical presentation of the theory and the pure applied tool to physical problems that are contained in other books. Improvements made in this second edition include corrected typographical errors; rewritten text to improve the flow and enrich the material; added exercises in all chapters; new applications in Chapters 1, 2, and 5 and expanded examples.

This text is designed for engineers, scientists, and mathematicians with a background in elementary ordinary differential equations and calculus. Rich in proofs, examples, and exercises, this widely adopted text emphasizes physics and engineering applications.

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The Student Solutions Manual can be downloaded free from Dover's site; the Instructor Solutions Manual is available upon request. 2004 edition, with minor revisions.

The main theme is the integration of the theory of linear PDE and the theory of finite difference and finite element methods. For each type of PDE, elliptic, parabolic, and hyperbolic, the text contains one chapter on the mathematical theory of the differential equation, followed by one chapter on finite difference methods and one on finite element methods. The chapters on elliptic equations are preceded by a chapter on the two-point boundary value problem for ordinary differential equations. Similarly, the chapters on time-dependent problems are preceded by a chapter on the initial-value problem for ordinary differential equations. There is

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also one chapter on the elliptic  
eigenvalue problem and eigenfunction  
expansion. The presentation does not

presume a deep knowledge of  
mathematical and functional analysis.

The required background on linear  
functional analysis and Sobolev spaces is  
reviewed in an appendix. The book is  
suitable for advanced undergraduate and  
beginning graduate students of applied  
mathematics and engineering.

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mathematical solutions  
and introduces applied  
mathematics while  
presenting differential  
equations. Coverage  
includes Fourier series,

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orthogonal functions,  
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Green's functions, and  
transform methods. This  
text is ideal for  
readers interested in  
science, engineering,  
and applied mathematics.  
This textbook is for the  
standard, one-semester,  
junior-senior course  
that often goes by the  
title "Elementary  
Partial Differential  
Equations" or "Boundary  
Value Problems;" The  
audience usually  
consists of students in  
mathematics,

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engineering, and the physical sciences. The topics include derivations of some of the standard equations of mathematical physics (including the heat equation, the wave equation, and the Laplace's equation) and methods for solving those equations on bounded and unbounded domains. Methods include eigenfunction expansions or separation of variables, and methods based on Fourier and Laplace transforms.

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Prerequisites include calculus and a post-calculus differential equations course. There are several excellent texts for this course, so one can legitimately ask why one would wish to write another. A survey of the content of the existing titles shows that their scope is broad and the analysis detailed; and they often exceed five hundred pages in length. These books generally have enough material for two, three, or even four

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semesters. Yet, many undergraduate courses are one-semester courses. The author has often felt that students become a little uncomfortable when an instructor jumps around in a long volume searching for the right topics, or only partially covers some topics; but they are secure in completely mastering a short, well-defined introduction. This text was written to provide a brief, one-semester introduction to

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partial differential equations.  
This text explores the essentials of partial differential equations as applied to engineering and the physical sciences. Discusses ordinary differential equations, integral curves and surfaces of vector fields, the Cauchy-Kovalevsky theory, more. Problems and answers. "Featuring a challenging, yet accessible, introduction to partial differential

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Equations provides a solid introduction to partial differential equations, particularly methods of solution based on characteristics, separation of variables, as well as Fourier series, integrals, and transforms. Thoroughly updated with novel applications, such as Poe's pendulum and Kepler's problem in astronomy, this third edition is updated to

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include the latest version of Maple, which is integrated throughout the text. New topical coverage includes novel applications, such as Poe's pendulum and Kepler's problem in astronomy" --

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Books a la Carte  
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Suitable for advanced undergraduate and graduate students, this text presents the general properties of partial differential equations, including the elementary theory of complex variables. Topics include one-dimensional wave equation, properties of elliptic and parabolic equations, separation of variables and Fourier series, nonhomogeneous problems, and analytic functions of a complex variable. Solutions. 1965 edition.

DIVBook focuses mainly on boundary-value and initial-boundary-value problems on spatially bounded and on unbounded domains; integral transforms; uniqueness and continuous dependence on data, first-order equations, and more. Numerous

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exercises included. /div

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at hand.

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***This book teaches basic methods of***

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*partial differential equations and introduces related important ideas associated with the analysis of numerical methods for those partial differential equations. Coverage details such topics as separation of variables, Fourier analysis, maximum principles, and energy estimates. The book introduces numerical methods in parallel to the classical theory and also includes many engaging exercises.*

*From the reviews of Numerical Solution of Partial Differential Equations in Science and Engineering: "The book by Lapidus and Pinder is a very comprehensive, even exhaustive, survey of the subject . . . [It] is unique in that it covers equally finite difference and finite element methods." Burrelle's "The authors have selected an elementary (but not simplistic) mode of presentation. Many different computational schemes*

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*are described in great detail . . . Numerous practical examples and applications are described from beginning to the end, often with calculated results given."*

*Mathematics of Computing "This volume . . . devotes its considerable number of pages to lucid developments of the methods [for solving partial differential equations] . . . the writing is very polished and I found it a pleasure to read!" Mathematics of Computation Of related interest . . .*

**NUMERICAL ANALYSIS FOR APPLIED SCIENCE**

*Myron B. Allen and Eli L. Isaacson. A modern, practical look at numerical analysis, this book guides readers through a broad selection of numerical methods, implementation, and basic theoretical results, with an emphasis on methods used in scientific computation involving differential equations. 1997 (0-471-55266-6) 512 pp. APPLIED*

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*MATHEMATICS Second Edition, J.  
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an Leser mit Kenntnissen aus einem  
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Mathematik (und Physik) und legt seinen  
Schwerpunkt auf die explizite Darstellung  
der Lösungen. Es ist deshalb besonders  
auch für Anwender (Physiker,  
Ingenieure) sowie für Nichtspezialisten,  
die die Methoden der mathematischen*

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*Physik kennenlernen wollen, interessant. Durch die große Anzahl von Beispielen und Übungsaufgaben eignet es sich gut zum Gebrauch neben Vorlesungen sowie zum Selbststudium.*

*This new edition features the latest tools for modeling, characterizing, and solving partial differential equations The Third Edition of this classic text offers a comprehensive guide to modeling, characterizing, and solving partial differential equations (PDEs). The author provides all the theory and tools necessary to solve problems via exact, approximate, and numerical methods. The Third Edition retains all the hallmarks of its previous editions, including an emphasis on practical applications, clear writing style and logical organization, and extensive use of real-world examples. Among the new and revised material, the book features: \* A new section at the end*

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*of each original chapter, exhibiting the use of specially constructed Maple procedures that solve PDEs via many of the methods presented in the chapters. The results can be evaluated numerically or displayed graphically. \* Two new chapters that present finite difference and finite element methods for the solution of PDEs. Newly constructed Maple procedures are provided and used to carry out each of these methods. All the numerical results can be displayed graphically. \* A related FTP site that includes all the Maple code used in the text. \* New exercises in each chapter, and answers to many of the exercises are provided via the FTP site. A supplementary Instructor's Solutions Manual is available. The book begins with a demonstration of how the three basic types of equations-parabolic, hyperbolic, and elliptic-can be derived from random*

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*walk models. It then covers an exceptionally broad range of topics, including questions of stability, analysis of singularities, transform methods, Green's functions, and perturbation and asymptotic treatments. Approximation methods for simplifying complicated problems and solutions are described, and linear and nonlinear problems not easily solved by standard methods are examined in depth. Examples from the fields of engineering and physical sciences are used liberally throughout the text to help illustrate how theory and techniques are applied to actual problems. With its extensive use of examples and exercises, this text is recommended for advanced undergraduates and graduate students in engineering, science, and applied mathematics, as well as professionals in any of these fields. It is possible to use the text, as in the past, without use of the new*

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flows, linear elasticity  
and complex  
characteristics.

The author would like to  
acknowledge his obligation  
to all his colleagues and  
friends at the Institute  
of Mathematical Sciences  
of New York University for  
their stimulation and  
criticism which have  
contributed to the writing  
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Larkin Joyner for drawing  
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*transform methods. This text is ideal for students in science, engineering, and applied mathematics.*

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*cylindrical, and spherical. Each of the equations is derived in the three-dimensional context; the solutions are organized according to the geometry of the coordinate system, which makes the mathematics especially transparent. Bessel and Legendre functions are studied and used whenever appropriate throughout the text. The notions of steady-state solution of closely related stationary solutions are developed for the heat*

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equation; applications to the study of heat flow in the earth are presented. The problem of the vibrating string is studied in detail both in the Fourier transform setting and from the viewpoint of the explicit representation (d'Alembert formula). Additional chapters include the numerical analysis of solutions and the method of Green's functions for solutions of partial differential equations.

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The exposition also includes asymptotic methods (Laplace transform and stationary phase). With more than 200 working examples and 700 exercises (more than 450 with answers), the book is suitable for an undergraduate course in partial differential equations.

Substantially revised, this authoritative study covers the standard finite difference methods of parabolic, hyperbolic, and elliptic equations, and includes

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*the concomitant theoretical work on consistency, stability, and convergence. The new edition includes revised and greatly expanded sections on stability based on the Lax-Richtmeyer definition, the application of Pade approximants to systems of ordinary differential equations for parabolic and hyperbolic equations, and a considerably improved presentation of iterative methods. A fast-paced introduction*

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*to numerical methods, this will be a useful volume for students of mathematics and engineering, and for postgraduates and professionals who need a clear, concise grounding in this discipline.*

*This book presents topics of science and engineering which occur in nature or are part of daily life. It describes phenomena which are modelled by partial differential equations, relating to physical variables like mass,*

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velocity and energy,  
etc. to their spatial  
and temporal variations.  
The author has chosen  
topics representing his  
career-long interests,  
including the flow of  
fluids and gases,  
granular flows,  
biological processes  
like pattern formation  
on animal skins,  
kinetics of rarified  
gases and semiconductor  
devices. Each topic is  
presented in its  
scientific or  
engineering context,  
followed by an

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introduction of  
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the reader how to formulate a  
partial differential equation  
from the physical problem and  
how to solve the equation.*

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Der Schwerpunkt liegt auf der  
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linearer partieller  
Differentialgleichungen mit der  
Theorie finiter  
Differenzenverfahren und der  
Theorie der Methoden finiter  
Elemente. Für jede Klasse  
partieller*

***Differentialgleichungen, d.h. elliptische, parabolische und hyperbolische, enthält der Text jeweils ein Kapitel zur mathematischen Theorie der Differentialgleichung gefolgt von einem Kapitel zu finiten Differenzenverfahren sowie einem zu Methoden der finiten Elemente. Den Kapiteln zu elliptischen Gleichungen geht ein Kapitel zum Zweipunkt-Randwertproblem für gewöhnliche Differentialgleichungen voran. Ebenso ist den Kapiteln zu zeitabhängigen Problemen ein Kapitel zum Anfangswertproblem für***

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**gewöhnliche  
Differentialgleichungen  
vorangestellt. Zudem gibt es  
ein Kapitel zum elliptischen  
Eigenwertproblem und zur  
Entwicklung nach  
Eigenfunktionen. Die  
Darstellung setzt keine tiefer  
gehenden Kenntnisse in  
Analysis und  
Funktionalanalysis voraus.  
Das erforderliche  
Grundwissen über lineare  
Funktionalanalysis und  
Sobolev-Räume wird im  
Anhang im Überblick  
besprochen.  
There are many excellent texts on  
elementary differential equation**

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***sdesignedfor the standard  
sophomore course. However,  
in spite of the fact that most  
courses are one semester in  
length, the texts have evolved  
into calculus-like pres-  
tations that include a large collection  
of methods and applications,  
packaged with student  
manuals, and Web-based  
notes, projects, and  
supplements. All of this comes  
in several hundred pages of  
text with busy formats. Most  
students do not have the time  
or desire to read voluminous  
texts and explore internet  
supplements. The format of  
this di?erential equations***

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***book is different; it is a one-semester, brief treatment of the basic ideas, models, and solution methods. Its limited coverage places it somewhere between an outline and a detailed textbook. I have tried to write concisely, to the point, and in plain language. Many worked examples and exercises are included. A student who works through this primer will have the tools to go to the next level in applying differential equations to problems in engineering, science, and applied mathematics. It can give some instructors, who want more concise coverage,***

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*an alternative to existing texts. An Introduction to Nonlinear Partial Differential Equations is a textbook on nonlinear partial differential equations. It is technique oriented with an emphasis on applications and is designed to build a foundation for studying advanced treatises in the field. The Second Edition features an updated bibliography as well as an increase in the number of exercises. All software references have been updated with the latest version of MATLAB®, the corresponding graphics have also been updated using*

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*Geared toward students of applied rather than pure mathematics, this volume introduces elements of partial differential equations. Its focus is primarily upon finding solutions to particular equations*

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*rather than general theory. Topics include ordinary differential equations in more than two variables, partial differential equations of the first and second orders, Laplace's equation, the wave equation, and the diffusion equation. A helpful Appendix offers information on systems of surfaces, and solutions to the odd-numbered problems appear at the end of the book. Readers pursuing independent study will particularly appreciate the worked examples that appear throughout the text.*

*These two volumes of 47 papers focus on the increased interplay of theoretical advances in nonlinear hyperbolic systems, completely integrable systems, and evolutionary systems of nonlinear partial differential equations. The papers both survey recent results and indicate future research trends in these vital and rapidly developing branches of PDEs. The editor has grouped the papers loosely into the*

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*following five sections: integrable systems,  
hyperbolic systems, variational problems,  
evolutionary systems, and dispersive*

*systems. However, the variety of the subjects  
discussed as well as their many interwoven  
trends demonstrate that it is through  
interactive advances that such rapid  
progress has occurred. These papers require  
a good background in partial differential  
equations. Many of the contributors are  
mathematical physicists, and the papers are  
addressed to mathematical physicists  
(particularly in perturbed integrable  
systems), as well as to PDE specialists and  
applied mathematicians in general.*

*Provides more than 150 fully solved  
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*Partial Differential Equations: Theory and  
Completely Solved Problems offers a  
modern introduction into the theory and  
applications of linear partial differential*

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*equations (PDEs). It is the material for a typical third year university course in PDEs.*

*The material of this textbook has been extensively class tested over a period of 20 years in about 60 separate classes. The book is divided into two parts. Part I contains the Theory part and covers topics such as a classification of second order PDEs, physical and biological derivations of the heat, wave and Laplace equations, separation of variables, Fourier series, D'Alembert's principle, Sturm-Liouville theory, special functions, Fourier transforms and the method of characteristics. Part II contains more than 150 fully solved problems, which are ranked according to their difficulty. The last two chapters include sample Midterm and Final exams for this course with full solutions.*

*This book is written to meet the needs of undergraduates in applied mathematics,*

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*physics and engineering studying partial differential equations. It is a more modern, comprehensive treatment intended for students who need more than the purely numerical solutions provided by programs like the MATLAB PDE Toolbox, and those obtained by the method of separation of variables, which is usually the only theoretical approach found in the majority of elementary textbooks. This will fill a need in the market for a more modern text for future working engineers, and one that students can read and understand much more easily than those currently on the market. \* Includes new and important materials necessary to meet current demands made by diverse applications \* Very detailed solutions to odd numbered problems to help students \* Instructor's Manual Available*

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