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Differential Equations

Matlab Differential Equations

This book provides a set of ODE/PDE integration routines in the six most widely used computer languages, enabling scientists and engineers to apply ODE/PDE

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analysis toward solving complex problems. This text concisely reviews integration algorithms, then analyzes the widely used Runge-Kutta method. It first presents a complete code before discussin

A Course in Ordinary Differential
EquationsCRC Press

The purpose of this book is solve partial

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differential equations using finite element methods through the Partial Differential Equation Matlab Toolbox. This product contains tools for the study and solution of partial differential equations (PDEs) in two-space dimensions (2-D) and time. A set of command-line functions and a graphical user interface let you preprocess, solve,

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and postprocess generic 2-D PDEs for a broad range of engineering and science applications. Partial Differential Equation Toolbox software is designed for both beginners and advanced users. The minimal requirement is that you can formulate a PDE problem on paper (draw the domain, write the boundary conditions,

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and the PDE). At the MATLAB command line, type `pdetool` This invokes the graphical user interface (GUI), which is a self-contained graphical environment for PDE solving. For common applications you can use the specific physical terms rather than abstract coefficients. Using `pdetool` requires no knowledge of the

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mathematics behind the PDE, the numerical schemes, or MATLAB. Advanced applications are also possible by downloading the domain geometry, boundary conditions, and mesh description to the MATLAB workspace. You can use functions to, for example, generate meshes, discretize your problem,

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interpolate, and plot data on unstructured grids.

This book presents the authors' recent work on the numerical methods for the stability analysis of linear autonomous and periodic delay differential equations, which consist in applying pseudospectral techniques to discretize either the solution

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operator or the infinitesimal generator and in using the eigenvalues of the resulting matrices to approximate the exact spectra. The purpose of the book is to provide a complete and self-contained treatment, which includes the basic underlying mathematics and numerics, examples from population dynamics and engineering

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applications, and Matlab programs implementing the proposed numerical methods. A number of proofs is given to furnish a solid foundation, but the emphasis is on the (unifying) idea of the pseudospectral technique for the stability analysis of DDEs. It is aimed at advanced students and researchers in applied

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mathematics, in dynamical systems and in various fields of science and engineering, concerned with delay systems. A relevant feature of the book is that it also provides the Matlab codes to encourage the readers to experience the practical aspects. They could use the codes to test the theory and to analyze the performances of the

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methods on the given examples. Moreover, they could easily modify them to tackle the numerical stability analysis of their own delay models.

A Problem Solving Approach Based on
MATLAB

MATLAB Manual, Ordinary Differential
Equations

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An Introduction to Differential Equations
Using MATLAB

Transform Methods for Solving Partial
Differential Equations

Method of Lines Analysis with Matlab

***This book focuses the
solutions of differential
equations with MATLAB.***

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Analytical solutions of differential equations are explored first, followed by the numerical solutions of different types of ordinary differential equations (ODEs), as well as the universal block diagram

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*based schemes for ODEs.
Boundary value ODEs,
fractional-order ODEs and
partial differential
equations are also
discussed.
A concise introduction to
numerical methods and the*

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*mathematical framework
needed to understand their
performance Numerical
Solution of Ordinary
Differential
Equations presents a complete
and easy-to-follow
introduction to*

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*classical topics in the
numerical solution of
ordinary
differential equations. The
book's approach not only
explains the
presented mathematics, but
also helps readers*

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understand how these numerical methods are used to solve real-world problems. Unifying perspectives are provided throughout the text, bringing together and categorizing different types of problems in order to help

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readers comprehend the applications of ordinary differentialequations. In addition, the authors' collective academic experienceensures a coherent and accessible discussion of key topics,including:

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*Euler's method Taylor and
Runge-Kutta methods General
error analysis for multi-
step methods Stiff
differential equations
Differential algebraic
equations Two-point boundary
value problems Volterra*

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integral equations Each chapter features problem sets that enable readers to test and build their knowledge of the presented methods, and a related Web site features MATLAB® programs that facilitate

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the exploration of numerical methods in greater depth. Detailed references outline additional literature on both analytical and numerical aspects of ordinary differential equations for further exploration of

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individual topics. Numerical Solution of Ordinary Differential Equations is an excellent textbook for courses on the numerical solution of differential equations at the upper-undergraduate and

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beginninggraduate levels. It also serves as a valuable reference forresearchers in the fields of mathematics and engineering.

Transform methods provide a bridge between the commonly used method of separation of

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variables and numerical techniques for solving linear partial differential equations. While in some ways similar to separation of variables, transform methods can be effective for a wider class of problems.

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Even when the inverse of the transform cannot be found ana

Operator splitting (or the fractional steps method) is a very common tool to analyze nonlinear partial differential equations both

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numerically and analytically. By applying operator splitting to a complicated model one can often split it into simpler problems that can be analyzed separately. In this book one studies operator

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splitting for a family of nonlinear evolution equations, including hyperbolic conservation laws and degenerate convection-diffusion equations. Common for these equations is the prevalence of rough, or non-

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smooth, solutions, e.g., shocks. Rigorous analysis is presented, showing that both semi-discrete and fully discrete splitting methods converge. For conservation laws, sharp error estimates are provided and for

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convection-diffusion equations one discusses a priori and a posteriori correction of entropy errors introduced by the splitting. Numerical methods include finite difference and finite volume methods as well as

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front tacking. The theory is illustrated by numerous examples. There is a dedicated web page that provides MATLAB codes for many of the examples. The book is suitable for graduate students and

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*researchers in pure and
applied mathematics,
physics, and engineering.
Using Matlab Differential
Equations
An Introduction to Partial
Differential Equations with
MATLAB*

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Differential Equations

***Differential Equations with
Matlab***

Revised Reprint

***A Course in Differential
Equations with Boundary
Value Problems***

***The book takes a problem solving
approach in presenting the topic of***

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differential equations. It provides a complete narrative of differential equations showing the theoretical aspects of the problem (the how's and why's), various steps in arriving at solutions, multiple ways of obtaining solutions and comparison of solutions. A large number of

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comprehensive examples are provided to show depth and breadth and these are presented in a manner very similar to the instructor's class room work. The examples contain solutions from Laplace transform based approaches alongside the solutions

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based on eigenvalues and eigenvectors and characteristic equations. The verification of the results in examples is additionally provided using Runge-Kutta offering a holistic means to interpret and understand the solutions. Wherever necessary,

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phase plots are provided to support the analytical results. All the examples are worked out using MATLAB® taking advantage of the Symbolic Toolbox and LaTeX for displaying equations. With the subject matter being presented through these descriptive

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examples, students will find it easy to grasp the concepts. A large number of exercises have been provided in each chapter to allow instructors and students to explore various aspects of differential equations.

A Course in Differential Equations

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with Boundary Value Problems, 2nd Edition adds additional content to the author's successful A Course on Ordinary Differential Equations, 2nd Edition. This text addresses the need when the course is expanded. The focus of the text is on applications and methods of

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solution, both analytical and numerical, with emphasis on methods used in the typical engineering, physics, or mathematics student's field of study. The text provides sufficient problems so that even the pure math major will be sufficiently

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challenged. The authors offer a very flexible text to meet a variety of approaches, including a traditional course on the topic. The text can be used in courses when partial differential equations replaces Laplace transforms. There is sufficient linear algebra in the text

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so that it can be used for a course that combines differential equations and linear algebra. Most significantly, computer labs are given in MATLAB®, Mathematica®, and Maple™. The book may be used for a course to introduce and equip the student with a knowledge

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of the given software. Sample course outlines are included. Features MATLAB®, Mathematica®, and Maple™ are incorporated at the end of each chapter. All three software packages have parallel code and exercises; There are numerous problems of varying

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difficulty for both the applied and pure math major, as well as problems for engineering, physical science and other students. An appendix that gives the reader a "crash course" in the three software packages. Chapter reviews at the end of each chapter to help the

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students review Projects at the end of each chapter that go into detail about certain topics and introduce new topics that the students are now ready to see Answers to most of the odd problems in the back of the book

A supplemental text that can enrich

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and enhance any first course in ordinary differential equations This supplement helps instructors move towards an earlier use of numerical and geometric methods, place a greater emphasis on systems (including nonlinear ones), and increase discussions of both the

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benefits and possible pitfalls in numerical solution of ODEs. By providing an introduction to the software that is integrated with the relevant mathematics, Differential Equations with MATLAB can perfectly complement and enhance other texts from Wiley. Since the

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third edition of Differential Equations with MATLAB first appeared in 2012, there have been many changes and enhancements to MATLAB and Simulink. These include addition of live scripts, new plotting commands, and major changes to the Symbolic Math

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Toolbox. This revised version brings the text completely up to date with the 2019a release of MATLAB.

Presents numerical methods and computer code in Matlab for the solution of ODEs and PDEs with detailed line-by-line discussion.

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***Computational Partial Differential
Equations Using MATLAB®
Analysis and MATLAB Programs
Differential Equations
Modeling with MATLAB
Calculus and Differential Equations
with MATLAB***

This book, first published in 2003,
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provides a concise but sound treatment of ODEs, including IVPs, BVPs, and DDEs.

The purpose of this book is solve partial differential equations using finite element methods through the Partial Differential Equation

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Matlab Toolbox. This product contains functions for the study and solution of partial differential equations (PDEs) in two-space dimensions (2-D) and time. A set of command-line functions and a graphical user interface let you

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preprocess, solve, and postprocess generic 2-D PDEs for a broad range of engineering and science applications. The functions are complemented by representative examples showing the functionality of MATLAB to solve differential

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equations in partial derivatives

*A unique textbook for an
undergraduate course on
mathematical modeling, Differential
Equations with MATLAB:
Exploration, Applications, and
Theory provides students with an*

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understanding of the practical and theoretical aspects of mathematical models involving ordinary and partial differential equations (ODEs and PDEs). The text presents a unifying picture inherent to the study and analysis of more than 20

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distinct models spanning disciplines such as physics, engineering, and finance. The first part of the book presents systems of linear ODEs. The text develops mathematical models from ten disparate fields, including pharmacokinetics,

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chemistry, classical mechanics, neural networks, physiology, and electrical circuits. Focusing on linear PDEs, the second part covers PDEs that arise in the mathematical modeling of phenomena in ten other areas, including heat conduction,

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wave propagation, fluid flow through fissured rocks, pattern formation, and financial mathematics. The authors engage students by posing questions of all types throughout, including verifying details, proving

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conjectures of actual results, analyzing broad strokes that occur within the development of the theory, and applying the theory to specific models. The authors' accessible style encourages students to actively work through the

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material and answer these questions. In addition, the extensive use of MATLAB® GUIs allows students to discover patterns and make conjectures.

*An Introduction to Partial
Differential Equations with*

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MATLAB, Second Edition illustrates the usefulness of PDEs through numerous applications and helps students appreciate the beauty of the underlying mathematics. Updated throughout, this second edition of a bestseller shows students how PDEs

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*can model diverse problems,
including the flow of heat,
Programming and Simulating
Ordinary and Partial Differential
Equations
Exploration, Applications, and
Theory*

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*Differential Equations with Matlab.
Examples and Exercises
An Introduction to Partial
Differential Equations with
MATLAB, Second Edition
Scientific and Engineering
Applications*

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*An Introduction to Partial
Differential Equations with
MATLAB® , Second Edition
illustrates the usefulness of PDEs
through numerous applications
and helps students appreciate
the beauty of the underlying
mathematics. Updated*

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throughout, this second edition of a bestseller shows students how PDEs can model diverse problems, including the flow of heat, the propagation of sound waves, the spread of algae along the ocean's surface, the fluctuation in the price of a stock

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option, and the quantum mechanical behavior of a hydrogen atom. Suitable for a two-semester introduction to PDEs and Fourier series for mathematics, physics, and engineering students, the text teaches the equations based on

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method of solution. It provides both physical and mathematical motivation as much as possible. The author treats problems in one spatial dimension before dealing with those in higher dimensions. He covers PDEs on bounded domains and then on

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unbounded domains, introducing students to Fourier series early on in the text. Each chapter's prelude explains what and why material is to be covered and considers the material in a historical setting. The text also contains many exercises,

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including standard ones and graphical problems using MATLAB. While the book can be used without MATLAB, instructors and students are encouraged to take advantage of MATLAB's excellent graphics capabilities. The MATLAB code

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used to generate the tables and figures is available in an appendix and on the author's website.

This textbook introduces several major numerical methods for solving various partial differential equations (PDEs) in

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science and engineering, including elliptic, parabolic, and hyperbolic equations. It covers traditional techniques that include the classic finite difference method and the finite element method as well as state-of-the-art numerical methods,

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such as the high-order compact difference method and the radial basis function meshless method. Helps Students Better Understand Numerical Methods through Use of MATLAB® The authors uniquely emphasize both theoretical numerical analysis

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and practical implementation of the algorithms in MATLAB, making the book useful for students in computational science and engineering. They provide students with simple, clear implementations instead of sophisticated usages of MATLAB

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*functions. All the Material
Needed for a Numerical Analysis
Course Based on the authors'
own courses, the text only
requires some knowledge of
computer programming,
advanced calculus, and
difference equations. It includes*

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practical examples, exercises, references, and problems, along with a solutions manual for qualifying instructors. Students can download MATLAB code from www.crcpress.com, enabling them to easily modify or improve the codes to solve their

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own problems.

Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB shows the reader how to exploit a fuller array of numerical methods for the analysis of complex scientific and engineering systems than is

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conventionally employed. The book is dedicated to numerical simulation of distributed parameter systems described by mixed systems of algebraic equations, ordinary differential equations (ODEs) and partial differential equations (PDEs).

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Special attention is paid to the numerical method of lines (MOL), a popular approach to the solution of time-dependent PDEs, which proceeds in two basic steps: spatial discretization and time integration. Besides conventional finite-difference and

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element techniques, more advanced spatial-approximation methods are examined in some detail, including nonoscillatory schemes and adaptive-grid approaches. A MOL toolbox has been developed within MATLAB®/OCTAVE/SCILAB. In

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addition to a set of spatial approximations and time integrators, this toolbox includes a collection of application examples, in specific areas, which can serve as templates for developing new programs.

Simulation of ODE/PDE Models

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with MATLAB® , OCTAVE and SCILAB provides a practical introduction to some advanced computational techniques for dynamic system simulation, supported by many worked examples in the text, and a collection of codes available for

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download from the book's page at www.springer.com. This text is suitable for self-study by practicing scientists and engineers and as a final-year undergraduate course or at the graduate level.

MATLAB is a platform for

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scientific computing that allows to work in virtually all areas of experimental sciences and engineering. Logically, this software allows to work in the field of differential equations presenting quite extensive capabilities. The number of

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*commands that implements
relating to differential equations
Matlab is quite high and very
efficient. In addition, it is
possible to continue with the
program methods manual
resolution algebraic already
known for each type of*

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*differential equation.
Approximate methods of
resolution of equations, systems
of differential equations and
differential equations in partial
derivatives are also implemented.
This book addresses all these
materials to develop the*

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*following topics: Introduction
practices to matlab Numerical
calculus with matlab Symbolic
calculus with matlab Matlab and
maple Graphics with matlab
General notation Help with
commands Escape and exit to the
environment ms-dos commands*

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Matlab and programming First order differential equations. Exact equations, separate variables, homogeneous and linear equations First order differential equations Equations in separated variables Homogeneous differential

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*equations Exact differential
equations Linear differential
equations Differential equations
of order superior. Transformed of
laplace and special types of
equations Ordinary high -order
equations Linear higher-order
equations. Homogeneous in*

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*constant coefficients equations.
Equations in constant coefficient
homogeneous. Variation of
parameters Non-homogeneous
equations with variable
coefficients. Cauchy -euler
equations Laplace transformed
Orthogonal polynomials Bessel*

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*and airy functions Differential
equations for approximate
methods Equations with superior
order and grade, linear and
nonlinear approximate methods
Taylor series method Runge
-kutta method Systems
differential equations and*

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*equations in finite differences
Systems homogeneous linear
equations with constant
coefficients Systems of equations
and linear not homo disposed
with constant coefficients
Equations in finite differences
Differential equations in partial*

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*derivatives Numerical calculus
with matlab. Applications to
differential equations Matlab and
programming Text editor Scripts
Functions and m-ficheros.
Function, eval and feval Local
and global variables Data types
Bucles for, while e if elseif The*

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*for loop The while loop If elseif
else end loop Switch and case
Continue Break Try ... Catch
Return Subfeatures Ordinary
differential equations using
methods of numerical calculus
Euler method Heun method The
taylor series method Equations in*

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*difference with the initial values,
values on the border and in
partial derivatives Solution
numerical differential equations
Ordinary differential equations
with initial values Ordinary
differential equations with values
in the border Differential*

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equations in partial derivatives

*Splitting Methods for Partial
Differential Equations with
Rough Solutions*

*Computational Partial
Differential Equations Using
MATLAB*

Problems with MATLAB Solutions

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*Matlab Functions for Partial
Differential Equations*

***Differential equations
and linear algebra are
two central topics in the
undergraduate***

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***mathematics curriculum.
This innovative textbook
allows the two subjects
to be developed either
separately or together,
illuminating the
connections between two***

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fundamental topics, and giving increased flexibility to instructors. It can be used either as a semester-long course in differential equations, or as a one-year course in

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***differential equations,
linear algebra, and
applications. Beginning
with the basics of
differential equations, it
covers first and second
order equations,***

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graphical and numerical methods, and matrix equations. The book goes on to present the fundamentals of vector spaces, followed by eigenvalues and

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***eigenvectors, positive
definiteness, integral
transform methods and
applications to PDEs. The
exposition illuminates the
natural correspondence
between solution***

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methods for systems of equations in discrete and continuous settings. The topics draw on the physical sciences, engineering and economics, reflecting the

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***author's distinguished
career as an applied
mathematician and
expositor.***

***MATLAB is a high-level
language and
environment for***

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***numerical computation,
visualization, and
programming. Using
MATLAB, you can analyze
data, develop algorithms,
and create models and
applications. The***

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language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming

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***languages, such as C/C++
or Java. MATLAB
Differential Equations
introduces you to the
MATLAB language with
practical hands-on
instructions and results,***

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***allowing you to quickly
achieve your goals. In
addition to giving an
introduction to the
MATLAB environment and
MATLAB programming,
this book provides all the***

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material needed to work on differential equations using MATLAB. It includes techniques for solving ordinary and partial differential equations of various kinds, and

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systems of such equations, either symbolically or using numerical methods (Euler's method, Heun's method, the Taylor series method, the Runge-Kutta

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method,...). It also describes how to implement mathematical tools such as the Laplace transform, orthogonal polynomials, and special functions (Airy and

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***Bessel functions), and
find solutions of finite
difference equations.
Employ the essential and
hands-on tools and
functions of MATLAB's
ordinary differential***

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equation (ODE) and partial differential equation (PDE) packages, which are explained and demonstrated via interactive examples and case studies. This book

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contains dozens of simulations and solved problems via m-files/scripts and Simulink models which help you to learn programming and modeling of more

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difficult, complex problems that involve the use of ODEs and PDEs. You'll become efficient with many of the built-in tools and functions of MATLAB/Simulink while

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***solving more complex
engineering and scientific
computing problems that
require and use
differential equations.***

***Practical MATLAB
Modeling with Simulink***

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explains various practical issues of programming and modelling. After reading and using this book, you'll be proficient at using MATLAB and applying the source code

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***from the book's examples
as templates for your
own projects in data
science or engineering.
What You Will
LearnModel complex
problems using MATLAB***

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***and SimulinkGain the
programming and
modeling essentials of
MATLAB using ODEs and
PDEsUse numerical
methods to solve 1st and
2nd order ODEsSolve***

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Differential Equations

***stiff, higher order,
coupled, and implicit
ODEsEmploy numerical
methods to solve 1st and
2nd order linear
PDEsSolve stiff, higher
order, coupled, and***

File Type PDF Matlab
Differential Equations

implicit PDEs Who This Book Is For Engineers, programmers, data scientists, and students majoring in engineering, applied/industrial math, data science, and

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File Type PDF Matlab
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scientific computing. This book continues where Apress' Beginning MATLAB and Simulink leaves off.

A fresh, forward-looking undergraduate textbook

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that treats the finite element method and classical Fourier series method with equal emphasis.

Numerical Solution of Ordinary Differential

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***Equations
Differential Equations
with Ordinary Differential
Equations Using MATLAB
Introduction to Partial
Differential Equations
with MATLAB***

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***Partial Differential
Equations With Matlab
Ordinary Differential
Equations Using MATLAB***

In this popular text for an Numerical Analysis course, the authors introduce several major methods of solving

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various partial differential equations (PDEs) including elliptic, parabolic, and hyperbolic equations. It covers traditional techniques including the classic finite difference method, finite element method, and state-of-the-art numerical methods. The text uniquely

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emphasizes both theoretical numerical analysis and practical implementation of the algorithms in MATLAB. This new edition includes a new chapter, Finite Value Method, the presentation has been tightened, new exercises and applications are

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included, and the text refers now to the latest release of MATLAB. Key Selling Points: A successful textbook for an undergraduate text on numerical analysis or methods taught in mathematics and computer engineering. This course is taught in

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every university throughout the world with an engineering department or school. Competitive advantage broader numerical methods (including finite difference, finite element, meshless method, and finite volume method), provides the

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MATLAB source code for most popular PDEs with detailed explanation about the implementation and theoretical analysis. No other existing textbook in the market offers a good combination of theoretical depth and practical

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source codes.

This monograph presents teaching material in the field of differential equations while addressing applications and topics in electrical and biomedical engineering primarily. The book contains problems with

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varying levels of difficulty, including Matlab simulations. The target audience comprises advanced undergraduate and graduate students as well as lecturers, but the book may also be beneficial for practicing engineers alike.

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Overview The subject of partial differential equations has an unchanging core of material but is constantly expanding and evolving. The core consists of solution methods, mainly separation of variables, for boundary value

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problems with constant coefficients in geometrically simple domains. Too often an introductory course focuses exclusively on these core problems and techniques and leaves the student with the impression that there is no more to the subject. Questions of

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existence, uniqueness, and well-posedness are ignored. In particular there is a lack of connection between the analytical side of the subject and the numerical side. Furthermore nonlinear problems are omitted because they are too hard to deal with

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analytically. Now, however, the availability of convenient, powerful computational software has made it possible to enlarge the scope of the introductory course. My goal in this text is to give the student a broader picture of the subject. In addition to

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the basic core subjects, I have included material on nonlinear problems and brief discussions of numerical methods. I feel that it is important for the student to see nonlinear problems and numerical methods at the beginning of the

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course, and not at the end when we run usually run out of time.

Furthermore, numerical methods should be introduced for each equation as it is studied, not lumped together in a final chapter.

Utilizing MATLAB's computational

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and graphical tools right from the start, this analysis of differential equations helps users probe a variety of mathematical models, encouraging them to develop problem-solving skills and independent judgment as they derive mathematical models,

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select approaches to their analysis, and find answers to the original physical questions. Providing immediate graphic and numeric support, it demonstrates how physical problems motivate the central ideas and techniques of differential

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equations, showing how they model physical phenomena by examining ideas from four perspectives: geometric, analytic, numeric, and physical. Introduces qualitative analysis and numerical methods for scalar equations and systems early on,

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without sacrificing coverage of the most important traditional analytical methods. Fully integrates MATLAB into the text and exercises, and uses mathematical models of physical problems throughout to emphasize the interplay between the physical

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problem and the analytic, graphical, and numeric information available from the differential equation model. Seamlessly integrates over 1,400 exercises, open-ended chapter projects, and motivational 'Thought Questions'. For scientists and

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Simulation of ODE/PDE Models with
MATLAB®, OCTAVE and SCILAB
Numerical Analysis of Partial
Differential Equations Using Maple
and MATLAB
Differential Equations and Linear
Algebra

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Numerical Computing with
MATLAB

Differential Equations with MATLAB

This book provides an elementary yet comprehensive introduction to the numerical solution of

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partial differential equations (PDEs). Used to model important phenomena, such as the heating of apartments and the behavior of electromagnetic waves, these equations have applications in engineering

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and the life sciences, and most can only be solved approximately using computers. Numerical Analysis of Partial Differential Equations Using Maple and MATLAB provides detailed descriptions of the

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four major classes of discretization methods for PDEs (finite difference method, finite volume method, spectral method, and finite element method) and runnable MATLAB® code for each of the discretization

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methods and exercises. It also gives self-contained convergence proofs for each method using the tools and techniques required for the general convergence analysis but adapted to the simplest setting to keep the

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