River Publishers Book Catalogue

Series in Mathematical, Statistical and Computational Modelling for Engineering

Solid Geometry with MATLAB Programming
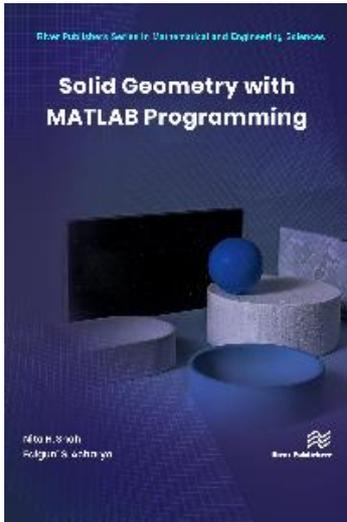
Authors:

Nita H. Shah, Gujarat University, India

Falguni S. Acharya, Parul University, India

Description:

Solid geometry is defined as the study of the geometry of three-dimensional solid figures in Euclidean space. There are numerous techniques in solid geometry, mainly analytic geometry and methods using vectors, since they use linear equations and matrix algebra. Solid geometry is quite useful in everyday life, for example, to design different signs and symbols such as octagon shape stop signs, to indicate traffic rules, to design different 3D objects like cubicles in gaming zones, innovative lifts, creative 3D interiors, and to design 3D computer graphics. Studying solid geometry helps students to improve visualization and increase logical thinking and creativity since it is applicable everywhere in day-to-day life. It builds up a foundation for advanced levels of mathematical studies. Numerous competitive exams include solid geometry since its foundation is required to study other branches like civil engineering, mechanical engineering, computer science engineering, architecture, etc.

This book is designed especially for students of all levels, and can serve as a fundamental resource for advanced level studies not only in mathematics but also in various fields like engineering, interior design, architecture, etc. It includes theoretical aspects as well as numerous solved examples. The book includes numerical problems and problems of construction as well as practical problems as an application of the respective topic. A special feature of this book is that it includes solved examples using the mathematical tool MATLAB.

Keywords: Plane, straight line, sphere, cone, cylinder, MATLAB programming

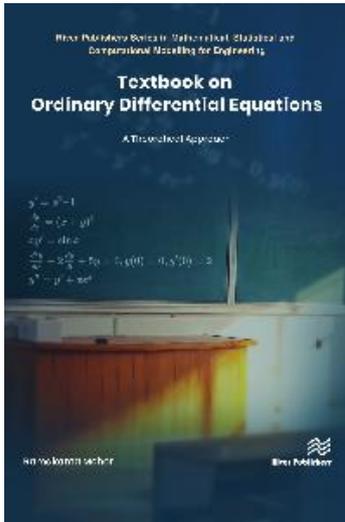# Textbook on Ordinary Differential Equations
A Theoretical Approach

Author: Ramakanta Meher, Sardar Vallabhbhai National Institute of Technology, India

Description:

Many scientific and real-world problems that occur in science, engineering, and medicine can be represented in differential equations. There is a vital role for differential equations in studying the behavior of different types of real-world problems. Thus, it becomes crucial to know the existence uniqueness properties of differential equations and various methods of finding differential equation solutions in explicit form. It is also essential to know different kinds of differential equations in terms of eigenvalues, termed eigenvalue problems, and some special functions used in finding the solution to differential equations. The study of nonlinear problems also plays a significant role in different real-world situations. There is a necessity to know the behavior of solutions of nonlinear differential equations. Still, there are very few forms of differential equations whose solution can be found in explicit form. For the differential equations whose solutions cannot be found in explicit form, one has to study the properties of solutions of the given differential equation to guess an approximate solution of it. This book aims to introduce all the necessary topics of differential equations in one book so that laymen can easily understand the subject and apply it in their research areas. The novel approach used in this book is that I have introduced different analytical methods for finding the solution of differential equations with sufficient theorems, corollaries, and examples, and the geometrical interpretations in each topic.

This textbook is intended to study the theory and methods of finding the explicit solutions to differential equations, wherever possible, and in the absence of finding explicit solutions. It is intended to study the properties of solutions to the given differential equations. This book is based on syllabi of the theory of differential equations prescribed for postgraduate students of mathematics and applied mathematics in different institutions and universities of India and abroad. This book will be helpful for competitive examinations as well.

Keywords: Differential equation; Green function; Sturm Liouville problems; local and non-local existence; critical points; Liapunov's function; stability theorem; analytical methods

Elementary Vector Calculus and Its Applications with MATLAB Programming
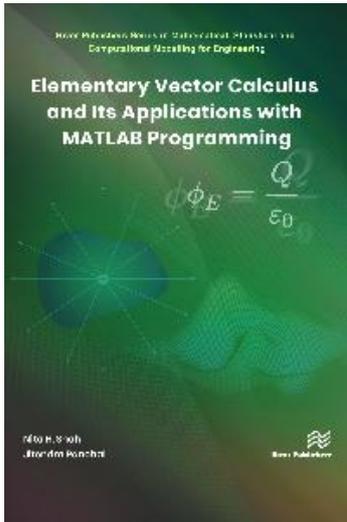
Authors:

Nita H. Shah, Head and Professor, Department of Mathematics, Gujarat University, India

Jitendra Panchal, Assistant Professor, Department of Applied Sciences & Humanities, Parul Institute of Engineering & Technology, Parul University, India

Description:

Sir Isaac Newton, one of the greatest scientists and mathematicians of all time, introduced the notion of a vector to define the existence of gravitational forces, the motion of the planets around the sun, and the motion of the moon around the earth. Vector calculus is a fundamental scientific tool that allows us to investigate the origins and evolution of space and time, as well as the origins of gravity, electromagnetism, and nuclear forces. Vector calculus is an essential language of mathematical physics, and plays a vital role in differential geometry and studies related to partial differential equations widely used in physics, engineering, fluid flow, electromagnetic fields, and other disciplines. Vector calculus represents physical quantities in two or three-dimensional space, as well as the variations in these quantities. The machinery of differential geometry, of which vector calculus is a subset, is used to understand most of the analytic results in a more general form. Many topics in the physical sciences can be mathematically studied using vector calculus techniques. This book is designed under the assumption that the readers have no prior knowledge of vector calculus. It begins with an introduction to vectors and scalars, and also covers scalar and vector products, vector differentiation and integrals, Gauss's theorem, Stokes's theorem, and Green's theorem. The MATLAB programming is given in the last chapter.

This book includes many illustrations, solved examples, practice examples, and multiple-choice questions.

Keywords: Vectors, scalars, vector differentiation, vector integration, MATLAB programming

Elementary Cluster Analysis: Four Basic Methods that (Usually) Work

Author: James C. Bezdek , University of Melbourne (visiting senior fellow), Australia
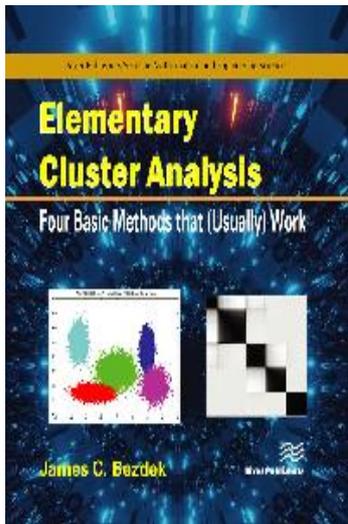
Description:

The availability of packaged clustering programs means that anyone with data can easily do cluster analysis on it. But many users of this technology don't fully appreciate its many hidden dangers. In today's world of "grab and go algorithms," part of my motivation for writing this book is to provide users with a set of cautionary tales about cluster analysis, for it is very much an art as well as a science, and it is easy to stumble if you don't understand its pitfalls. Indeed, it is easy to trip over them even if you do! The parenthetical word usually in the title is very important, because all clustering algorithms can and do fail from time to time.

Modern cluster analysis has become so technically intricate that it is often hard for the beginner or the non-specialist to appreciate and understand its many hidden dangers. Here's how Yogi Berra put it, and he was right:

In theory there's no difference between theory and practice. In practice, there is ~Yogi Berra

This book is a step backwards, to four classical methods for clustering in small, static data sets that have all withstood the tests of time. The youngest of the four methods is now almost 50 years old:

Gaussian Mixture Decomposition (GMD, 1898)
SAHN Clustering (principally single linkage (SL, 1909))
Hard c-means (HCM, 1956, also widely known as (aka) "k-means")
Fuzzy c-means (FCM, 1973, reduces to HCM in a certain limit)

The dates are the first known writing (to me, anyway) about these four models. I am (with apologies to Marvel Comics) very comfortable in calling HCM, FCM, GMD and SL the Fantastic Four.

Cluster analysis is a vast topic. The overall picture in clustering is quite overwhelming, so any attempt to swim at the deep end of the pool in even a very specialized subfield requires a lot of training. But we all start out at the shallow end (or at least that's where we should start!), and this book is aimed squarely at teaching toddlers not to be afraid of the water. There is no section of this book that, if explored in real depth, cannot be expanded into its own volume. So, if your needs are for an in-depth treatment of all the latest developments in any topic in this volume, the best I can do - what I will try to do anyway - is lead you to the pool, and show you where to jump in.

Keywords: Cluster Analysis, Unsupervised Learning, k-Means models, Single Linkage, Big Data, Streaming Data
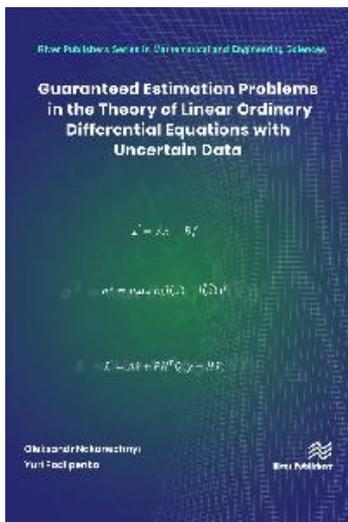
Guaranteed Estimation Problems in the Theory of Linear Ordinary Differential Equations with Uncertain Data

Authors:

Oleksandr Nakonechnyi, Taras Shevchenko National University of Kyiv, Ukraine

Yuri Podlipenko, Taras Shevchenko National University of Kyiv, Ukraine

Description:

This monograph is devoted to the construction of optimal estimates of values of linear functionals on solutions to Cauchy and two-point boundary value problems for systems of linear first-order ordinary differential equations, from indirect observations which are linear transformations of the same solutions perturbed by additive random noises. It is assumed that right-hand sides of equations and boundary data as well as statistical characteristics of random noises in observations are not known and belong to certain given sets in corresponding functional spaces. This leads to the necessity of introducing the minimax statement of an estimation problem when optimal estimates are defined as linear, with respect to observations, estimates for which the maximum of mean square error of estimation taken over the above-mentioned sets attains minimal value. Such estimates are called minimax or guaranteed estimates. It is established that these estimates are expressed explicitly via solutions to some uniquely solvable linear systems of ordinary differential equations of the special type. The authors apply these results for obtaining the optimal estimates of solutions from indirect noisy observations.

Similar estimation problems for solutions of boundary value problems for linear differential equations of order n with general boundary conditions are considered. The authors also elaborate guaranteed estimation methods under incomplete data of unknown right-hand sides of equations and boundary data and obtain representations for the corresponding guaranteed estimates. In all the cases estimation errors are determined.

Keywords: guaranteed estimates, estimation errors, noisy observations, Cauchy problem, boundary value problems, linear ordinary differential equations

Advanced Applications of Computational Mathematics

Editors:

Akshay Kumar, Graphic Era Hill University, India

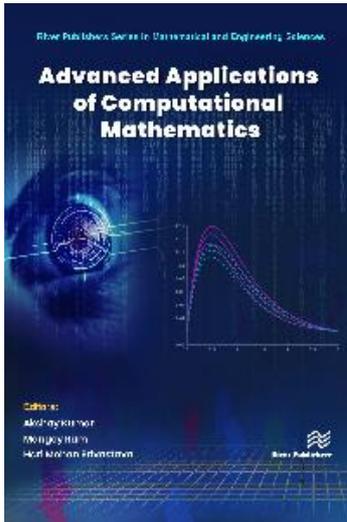Mangey Ram, Graphic Era Deemed to be University, India

Hari Mohan Srivastava, University of Victoria, Canada

ISBN: 9788770226059

e-ISBN: 9788770226042

Available From: October 2021

Price: € 95.50

Description:

This book "Advanced Applications of Computational Mathematics" covers multidisciplinary studies containing advanced research in the field of computational and applied mathematics. The book includes research methodology, techniques, applications, and algorithms. The book will be very useful to advanced students, researchers and practitioners who are involved in the areas of computational and applied mathematics and engineering.

Keywords: Image segmentation, iris recognition, Hough transforms, nonlinear radiation; soret and dufour effects, geometric algebra, spacetime algebra, dirac equation, Shannon information, Jensen's inequality, local bounds, scalar potential, Filippov system, piecewise smooth, buffet, Lipschitz-condition and continuous function, analytic functions, entropy generation, homotopy analytic scheme, computation, chemical reaction, power series, Hesitant fuzzy set, distance measure, feature selection, support vector machines, Kernel functions, stability analysis, Sensitivity analysis, Bifurcation, maximum lyapunov exponent.

River Publishers Series in Mathematical, Statistical and Computational Modelling for Engineering

Special Functions and Their Applications

Authors:

Bipin Singh Koranga, Kirori Mal College, Delhi University, India

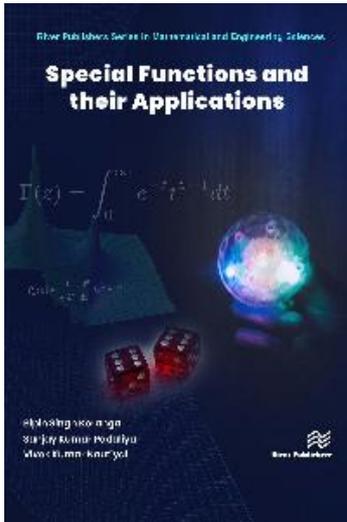Sanjay Kumar Padaliya, S.G.R.R. (P.G.) College, India

Vivek Kumar Nautiyal, Babasaheb Bhimrao Ambedkar University, India

ISBN: 9788770226264

e-ISBN: 9788770226257

Available From: October 2021

Price: € 95.00

Description:

Special functions are mathematical functions that have established names and notations due to their importance in mathematical analysis, functional analysis, geometry, physics, or other applications. This short text gives clear descriptions and explanations of the Gamma function, the Probability Integral and its related functions, Spherical Harmonics Theory, The Bessel function, Hermite polynomials and Laguerre polynomials. Each chapter finishes with a description of how the function is most commonly applied and a set of examples for the student to work through.

Keywords: Gamma function, Probability Integral, Probability Theory, Probability Fresnel Integrals, Hypergeometric Equation, Legendre Functions, Legendre's Equation, Bessel Functions, Orthonormality, Generating Function, Hermite Functions, Rodrigues Formula, Hypergeometric Equation, Associated Legendre Functions, Associated Laguerre Polynomials.

An Introduction to Tensor Analysis
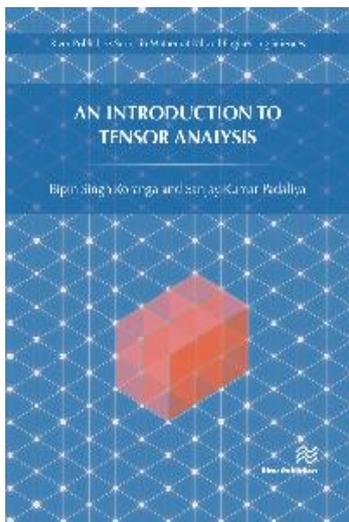
Authors:

Bipin Singh Koranga, Kirori Mal College, India

Sanjay Kumar Padaliya, S.G.R.R. (P.G) College, India

Available From: November 2020

Price: € 70.00

Description:
The subject of Tensor Analysis deals with the problem of the formulation of the relation between various entities in forms which remain invariant when we pass from one system of coordinates to another. The invariant form of equation is necessarily related to the possible system of coordinates with reference to which the equation remains invariant. The primary purpose of this book is the study of the invariance form of equation relative to the totally of the rectangular co-ordinate system in the three-dimensional Euclidean space. We start with the consideration of the way the sets representing various entities are transformed when we pass from one system of rectangular co-ordinates to another. A Tensor may be a physical entity that can be described as a Tensor only with respect to the manner of its representation by means of multi-sux sets associated with different system of axes such that the sets associated with different system of co-ordinate obey the transformation law for Tensor. We have employed sux notation for tensors of any order, we could also employ single letter such A,B to denote Tensors.

Keywords: Cartesian Tensors , General Tensors

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River Publishers Series in Mathematical, Statistical and Computational Modelling for Engineering

Advances in Applied Mathematical Analysis and Applications

Editors:

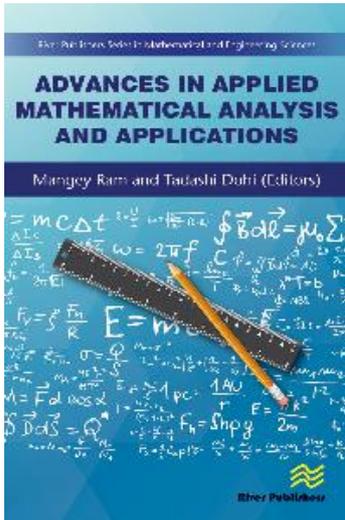Mangey Ram, Graphic Era Deemed to be University, Dehradun, India

Tadashi Dohi, Hiroshima University, Japan

ISBN: 9788770221108

e-ISBN: 9788770221092

Available From: August 2019

Price: € 95.00

Description:

In recent years, applied mathematics has been used in all novel disciplines of scientific development. Advances in Applied Mathematical Problems summarizes interdisciplinary work within the field of applied mathematics.

The topics discussed in the book include:

- Similarity Solutions of Spherical Shock Waves in a Self-Gravitating Ideal Gas
- Dual Solutions for Finite Element Analysis of Unsteady Hydromagnetic Stagnation Point Flow of Water Nanofluid Generated by Stretching Sheet
- Multiparametric modeling of carbon cycle in temperate wetlands for regional climate change analysis using satellite data
- An Intelligent Neuro Fuzzy System for Pattern Classification
- Fuzzy inventory model with demand, deterioration and inflation: a comparative study through NGTFN and CNTFN
- Summability and its application for the stability of the system
- Design Of Manufacturing, Control, And Automation Systems
- SEIR - Application for Crop through Water and Soil Texture
- Advances in radial basis functions
- Modeling For Time Period Of Natural Frequency For Non-Homogeneous Square Plate With Variable Thickness And Temperature Effect
- A Study On Metric Fixed Point Theorems Satisfying Integral Type Contractions
- Objective Function - In Radiometric Studies -Application to Agrs Surveys Associated With Radon
- Modelling Kernel Function in Black body Radiation Inversion

Keywords: Lie Group, Imploding Shock Waves, Similarity Solutions, Rankine-Hugoniot Conditions, Ideal Gas, Magnetic Field, Finite element analysis, unsteady hydromagnetic flow, stagnation point, nanofluid, stretching sheet, methane models, wetlands, satellite data,

Mathematical Modelling of System Resilience

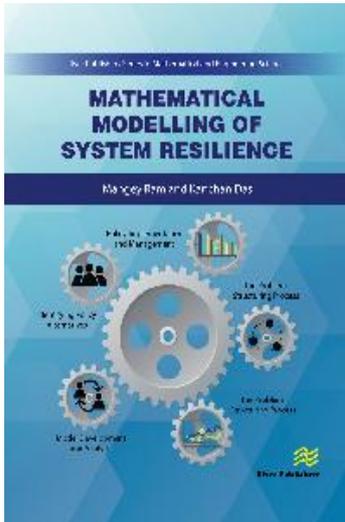**Authors:**

Kanchan Das, East Carolina University, USA

Mangey Ram, Graphic Era University, Dehradun, India

ISBN: 9788770220705

e-ISBN: 9788770220699

Available From: May 2019

Price: € 95.00

Description:

Almost all the systems in our world, including technical, social, economic, and environmental systems, are becoming interconnected and increasingly complex, and as such they are vulnerable to various risks. Due to this trend, resilience creation is becoming more important to system managers and decision makers, this to ensure sustained performance. In order to be able to ensure an acceptable sustained performance under such interconnectedness and complexity, resilience creation with a system approach is a requirement. Mathematical modeling based approaches are the most common approach for system resilience creation.

Mathematical Modelling of System Resilience covers resilience creation for various system aspects including a functional system of the supply chain, overall supply chain systems; various methodologies for modeling system resilience; satellite-based approach for addressing climate related risks, repair-based approach for sustainable performance of an engineering system, and modeling measures of the reliability for a vertical take-off and landing system. Each of the chapters contributes state of the art research for the relevant resilience related topic covered in the chapter.

Technical topics covered in the book include:

- Supply chain risk, vulnerability and disruptions
- System resilience for containing failures and disruptions
- Resiliency considering frequency and intensities of disasters
- Resilience performance index
- Resiliency of electric Traction system
- Degree of resilience
- Satellite observation and hydrological risk
- Latitude of Resilience
- On-line repair for resilience
- Reliability design for Vertical Takeoff and landing Prototype

Keywords: Supply Chain Disruptions; Risk management; vulnerability; disruption; system resilience; resilience performance coefficient; containment measures; absorption capability; adaptability, recoverability, engineering resilience, ecological resiliency, attractor based resilience; viability based resilience; reliability, resilience, electric vehicle, multiphase electric motor, multilevel electric inverter; flood mapping, quantitative risk assessment, Landsat, spectral index, calibration, in-field spectrometry, data regularization; performance measure of a complex system; on-line repair , asymptotic behavior; Circular consecutive system; stochastic modelling, reliability measures, VTOL system, redundancy, aircraft.

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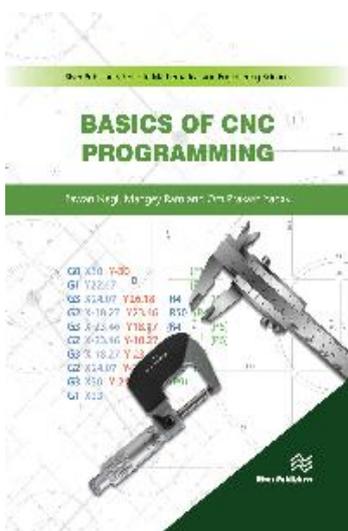# Basics of CNC Programming

Authors:

Pawan Negi, Graphic Era Deemed to be University, Dehradun, India

Mangey Ram, Graphic Era Deemed to be University, Dehradun, India

Om Prakash Yadav, North Dakota State University, North Dakota, USA

Description:

Before the introduction of automatic machines and automation, industrial manufacturing of machines and their parts for the key industries were made though manually operated machines. Due to this, manufacturers could not make complex profiles or shapes with high accuracy. As a result, the production rate tended to be slow, production costs were very high, rejection rates were high and manufacturers often could not complete tasks on time.

Industry was boosted by the introduction of the semi-automatic manufacturing machine, known as the NC machine, which was introduced in the 1950's at the Massachusetts Institute of Technology in the USA. After these NC machine started to be used, typical profiles and complex shapes could get produced more readily, which in turn lead to an improved production rate with higher accuracy.

Thereafter, in the 1970's, an even larger revolutionary change was introduced to manufacturing, namely the use of the CNC machine (Computer Numerical Control). Since then, CNC has become the dominant production method in most manufacturing industries, including automotive, aviation, defence, oil and gas, medical, electronics industry, and the optical industry.

Basics of CNC Programming describes how to design CNC programs, and what cutting parameters are required to make a good manufacturing program. The authors explain about cutting parameters in CNC machines, such as cutting feed, depth of cut, rpm, cutting speed etc., and they also explain the G codes and M codes which are common to CNC. The skill-set of CNC program writing is covered, as well as how to cut material during different operations like straight turning, step turning, taper turning, drilling, chamfering, radius profile, profile turning etc. In so doing, the authors cover the level of CNC programming from basic to industrial format. Drawings and CNC programs to practice on are also included for the reader.

Keywords: CNC Machine, CNC Programming, Turning Machine Programming, Preparatory and Miscellaneous Code (G & M Code), Turning Operation, Adjustable Cutting Factor in Turning Machine, Cutting Speed, Spindle Speed, Depth of Cut, Cutting Tool Geometry, Cutting Tool Tip Location, Procedure of CNC Program, Machine Zero, Work Zero, Machine Axis, Turning Machine Coordinates, Model Command and Non Model