Online Library Linear And Quadratic Functions Uh

When somebody should go to the book stores, search initiation by shop, shelf by shelf, it is truly problematic. This is why we provide the ebook compilations in this website. It will no question ease you to see guide **Linear And Quadratic Functions Uh** as you such as.

By searching the title, publisher, or authors of guide you in fact want, you can discover them rapidly. In the house, workplace, or perhaps in your method can be every best area within net connections. If you plan to download and install the Linear And Quadratic Functions Uh, it is totally easy then, before currently we extend the belong to to purchase and make bargains to download and install Linear And Quadratic Functions Uh therefore simple!

9JLUIN - ELSA ARIANA

Modeling and prediction of oceanographic phenomena and climate is based on the integration of dynamic equations. The Equations of Oceanic Motions derives and systematically classifies the most common dynamic equations used in physical oceanography, from large-scale thermohaline circulations to those governing small scale motions and turbulence. After establishing the basic dynamical equations that describe all oceanic motions, Müller then derives approximate equations, emphasizing the assumptions made and physical processes eliminated. He distinguishes between geometric, thermodynamic and dynamic approximations and between the acoustic, gravity, vortical and temperature-salinity modes of motion. Basic concepts and formulae of equilibrium thermodynamics, vector and tensor calculus, curvilinear coordinate systems, and the kinematics of fluid motion and wave propagation are covered in appendices. Providing the basic theoretical background for graduate students and researchers of physical oceanography and climate science, this book will serve as both a comprehensive text and an essential reference.

Elasticity theory is a classical discipline. The mathematical theory of elasticity in mechanics, especially the linearized theory, is quite mature, and is one of the foundations of several engineering sciences. In the last twenty years, there has been significant progress in several areas closely related to this classical field, this applies in particular to the following two areas. First, progress has been made in numerical methods, especially the development of the finite element method. The finite element method, which was independently created and developed in different ways by sci entists both in China and in the West, is a kind of systematic and modern numerical method for solving partial differential equations, especially el liptic equations. Experience has shown that the finite element method is efficient enough to solve problems in an extremely wide range of applica tions of elastic mechanics. In particular, the finite element method is very suitable for highly complicated problems. One of the authors (Feng) of this book had the good fortune to participate in the work of creating and establishing the theoretical basis of the finite element method. He thought in the early sixties that the method could be used to solve computational problems of solid mechanics by computers. Later practice justified and still continues to justify this point of view. The authors believe that it is now time to include the finite element method as an important part of the content of a textbook of modern elastic mechanics.

This three-volume set LNAI 8724, 8725 and 8726 constitutes the refereed proceedings of the European Conference on Machine Learning and Knowledge Discovery in Databases: ECML PKDD 2014, held in Nancy, France, in September 2014. The 115 revised research papers presented together with 13 demo track papers, 10 nectar track papers, 8 PhD track papers, and 9 invited talks were carefully reviewed and selected from 550 submissions. The papers cover the latest high-quality interdisciplinary research results in all areas related to machine learning and knowledge discovery in databases.

During the last two decades the boundary element method has experienced a remarkable evolution. Contemporary concepts and techniques leading to the advancements of capabilities and understanding of the mathematical and computational aspects of the method in mechanics are presented. The special emphasis on theoretical and numerical issues, as well as new formulations and approaches for special and important fields of solid and fluid mechanics are considered. Several important and new mathematical aspects are presented: singularity and hypersingular formulations, regularity, errors and error estimators, adaptive methods, Galerkin formulations, coupling of BEM-FEM and non-deterministic (stochastic and fuzzy) BEM formulations. Novel developments and applications of the boundary element method in various fields of mechanics of solids and fluids are considered: heat conduction, diffusion and radiation, non-linear problems, dynamics and time-depending problems, fracture mechanics, thermoelasticity and poroelasticity, aerodynamics and acoustics, contact problems, biomechanics, optimization and sensitivity analysis problems, ill posed and inverse problems, and identification problems.

This work focuses on computational methods in continuum thermomechanics. The text is based on the author's lectures, which ensures a didactical and coherent buildup. The main emphasis is put on the presentation of ideas and qualitative considerations, illustrated by specific examples and applications. Conditions and explanations that are essential for the practical application of methods are discussed thoroughly.

This book brings together the mathematical and numerical frameworks needed for developing digital twins. Starting from the basics—probability, statistics, numerical methods, optimization, and machine learning—and moving on to data assimilation, inverse problems, and Bayesian uncertainty quantification, the book provides a comprehensive toolbox for digital twins. Emphasis is also placed on the design process, denoted as the “inference cycle,” the aim of which is to propose a global methodology for complex problems. Readers will find guidelines and decision trees to help them choose the right tools for the job; a comprehensive reference section with all recent methods, covering both model-based and data-driven approaches; a vast selection of examples and all accompanying code; and a companion website containing updates, case studies, and extended material. A Toolbox for Digital Twins: From Model-Based to Data-Driven is for researchers and engineers, engineering students, and scientists in any domain where data and models need to be coupled to produce digital twins.

This book provides a comprehensive and accessible presentation of algorithms for solving continuous optimization problems. It relies on rigorous mathematical analysis, but also aims at an intuitive exposition that makes use of visualization where possible. It places particular emphasis on modern developments, and their widespread applications in fields such as large-scale resource allocation problems, signal processing, and machine learning. The 3rd edition brings the book in closer harmony with the companion works Convex Optimization Theory (Athena Scientific, 2009), Convex Optimization Algorithms (Athena Scientific, 2015), Convex Analysis and Optimization (Athena Scientific, 2003), and Network Optimization (Athena Scientific, 1998). These works are complementary in that they deal primarily with convex, possibly nondifferentiable, optimization problems and rely on convex analysis. By contrast the nonlinear programming book focuses primarily on analytical and computational methods for possibly nonconvex differentiable problems. It relies primarily on calculus and variational analysis, yet it still contains a detailed presentation of duality theory and its uses for both convex and nonconvex problems. This on-line edition contains detailed solutions to all the theoretical book exercises. Among its special features, the book: Provides extensive coverage of iterative optimization methods within a unifying framework Covers in depth duality theory from both a variational and a geometric point of view Provides a detailed treatment of interior point methods for linear programming Includes much new material on a number of topics, such as proximal algorithms, alternating direction methods of multipliers, and conic programming Focuses on large-scale optimization topics of much current interest, such as first order methods, incremental methods, and distributed asynchronous computation, and their applications in machine learning, signal processing, neural network training, and big data applications Includes a large number of examples and exercises Was developed through extensive classroom use in first-year graduate courses

Following on from the companion volume Principles of Magnetohydrodynamics, this textbook analyzes the applications of plasma physics to thermonuclear fusion and plasma astrophysics from the single viewpoint of MHD. This approach turns out to be ever more powerful when applied to streaming plasmas (the vast majority of visible matter in the Universe), toroidal plasmas (the most promising approach to fusion energy), and nonlinear dynamics (where it all comes together with modern computational techniques and extreme transonic and relativistic plasma flows). The textbook interweaves theory and explicit calculations of waves and instabilities of streaming plasmas in complex magnetic geometries. It is ideally suited to advanced undergraduate and graduate courses in plasma physics and astrophysics.

Numerical Simulation of Non-Newtonian Flow focuses on the numerical simulation of non-Newtonian flow using finite difference and finite element techniques. Topics range from the basic equations governing non-Newtonian fluid mechanics to flow classification and finite element calculation of flow (generalized Newtonian flow and viscoelastic flow). An overview of finite difference and finite element methods is also presented. Comprised of 11 chapters, this volume begins with an introduction to non-Newtonian mechanics, paying particular attention to the rheometrical properties of non-Newtonian fluids as well as non-Newtonian flow in complex geometries. The role of non-Newtonian fluid mechanics is also considered. The discussion then turns to the basic equations governing non-Newtonian fluid mechanics, including Navier Stokes equations and rheological equations of state. The next chapter describes a flow classification in which the various flow problems are grouped under five main headings: flows dominated by shear viscosity, slow flows (slightly elastic liquids), small deformation flows, nearly-viscometric flows, and long-range memory effects in complex flows. The remainder of the book is devoted to numerical analysis of non-Newtonian fluids using finite difference and finite element techniques. This monograph will be of interest to students and practitioners of physics and mathematics.

One of the main ways by which we can understand complex processes is to create computerised numerical simulation models of them. Modern simulation tools are not used only by experts, however, and reliability has therefore become an important issue, meaning that it is not sufficient for a simulation package merely to print out some numbers, claiming them to be the desired results. An estimate of the associated error is also needed. The errors may derive from many sources: errors in the model, errors in discretization, rounding errors, etc. Unfortunately, this situation does not obtain for current packages and there is a great deal of room for improvement. Only if the error can be estimated is it possible to do something to reduce it. The contributions in this book cover many aspects of the subject, the main topics being error estimates and error control in numerical linear algebra algorithms (closely related to the concept of condition numbers), interval arithmetic and adaptivity for continuous models.

This book is a practical guide to the numerical solution of linear and nonlinear equations, differential equations, optimization problems, and eigenvalue problems. It treats standard problems and introduces important variants such as sparse systems, differential-algebraic equations, constrained optimization, Monte Carlo simulations, and parametric studies. Stability and error analysis are emphasized, and the Matlab algorithms are grounded in sound principles of software design and understanding of machine arithmetic and memory management. Nineteen case studies provide experience in mathematical modeling and algorithm design, motivated by problems in physics, engineering, epidemiology, chemistry, and biology. The topics included go well beyond the standard first-course syllabus, introducing important problems such as differential-algebraic equations and conic optimization problems, and important solution techniques such as continuation methods. The case studies cover a wide variety of fascinating applications, from modeling the spread of an epidemic to determining truss configurations.

This book is a collection of lecture notes for the LIASFMA Shanghai Summer School on 'One-dimensional Hyperbolic Conservation Laws and Their Applications' which was held during August 16 to August 27, 2015 at Shanghai Jiao Tong University, Shanghai, China. This summer school is one of the activities promoted by Sino-French International Associate Laboratory in Applied Mathematics (LIASFMA in short). LIASFMA was established jointly by eight institutions in China and France in 2014, which is aimed at providing a platform for some of the leading French and Chinese mathematicians to conduct in-depth researches, extensive exchanges, and student training in the field of applied mathematics. This summer school has the privilege of being the first summer school of the newly established LIASFMA, which makes it significant.

There has long been dispute in mathematics between the drill and practice orientation that focuses primarily on memorizing mathematics as meaningless rote algorithms and the approach based on understanding and making creative use of mathematics. This 25-chapter book, based on a 7-year study at the University of Illinois, seeks to explain and diffuse this controversy by taking a broad view of the cognitive science approach to the teaching and learning of mathematics. This explanation of the processes of mathematical calculation owes much to the new approach to the study of knowledge, which has been developed from Jean Piaget's observation of child behavior and the broad range of new research into artificial intelligence. It is essentially concerned with providing a deeper understanding of the thought processes that are involved in mathematical thinking; what goes on inside children's heads as they learn mathematics and do mathematical problem-solving. Among the areas considered are: the cognitive science approach to mathematics education; deficiency in typical school curricula; the nature of representations; the "paradigm" teaching strategy; recognition problems; retrieval, construction, and mapping; and basic concepts used to facilitate the discussion of human information processing as it related to solving mathematical problems. (JN)

A unified treatment of fluid mechanics, analysis and numerical analysis appropriate for first year graduate students.

This book offers a comprehensive presentation of some of the most successful and popular domain decomposition preconditioners for finite and spectral element approximations of partial differential equations. It places strong emphasis on both algorithmic and mathematical aspects. It covers in detail important methods such as FETI and balancing Neumann-Neumann methods and algorithms for spectral element methods.

Nonlinear elliptic differential equations are a diverse subject with important applications to the physical and social sciences and engineering. They also arise naturally in geometry. In particular, much of the progress in the area in the twentieth century was driven by geometric applications, from the Bernstein problem to the existence of Kähler–Einstein metrics. This book, designed as a textbook, provides a detailed discussion of the Dirichlet problems for quasilinear and fully nonlinear elliptic differential equations of the second order with an emphasis on mean curvature equations and on Monge–Ampère equations. It gives a user-friendly introduction to the theory of nonlinear elliptic equations with special attention given to basic results and the most important techniques. Rather than presenting the topics in their full generality, the book aims at providing self-contained, clear, and “elementary” proofs for results in important special cases. This book will serve as a valuable resource for graduate students or anyone interested in this subject.

Thoroughly revised and updated for the second edition, this comprehensive textbook integrates basic and advanced concepts of mechanics with numerical methods and biomedical applications. Coverage is expanded to include a complete introduction to vector and tensor calculus, and new or fully updated chapters on biological materials and continuum mechanics, motion, deformation and rotation, and constitutive modelling of solids and fluids. Topics such as kinematics, equilibrium, and stresses and strains are also included, as well as the mechanical behaviour of fibres and the analysis of one-dimensional continuous elastic media. Numerical solution procedures based on the Finite Element Method are presented, with accompanying MATLAB-based software and dozens of new biomedical engineering examples and exercises allowing readers to practise and improve their skills. Solutions for instructors are also available online. This is the definitive guide for both undergraduate and graduate students taking courses in biomechanics.
the conference participants. We also thank M. Koleva for the help in putting together the book.
This text on finite element-based computational methods for solving incompressible viscous fluid flow problems shows readers how to split complicated computational fluid dynamics problems into a sequence of simpler sub-problems. A methodology for solving more advanced applications such as hemispherical cavity flow, cavity flow of an Oldroyd-B viscoelastic flow, and particle interaction in an Oldroyd-B type viscoelastic fluid is also presented.
This book is a tutorial written by researchers and developers behind the FEniCS Project and explores an advanced, expressive approach to the development of mathematical software. The presentation spans mathematical background, software design and the use of FEniCS in applications. Theoretical aspects are complemented with computer code which is available as free/open source software. The book begins with a special introductory tutorial for beginners. Following are chapters in Part I addressing fundamental aspects of the approach to automating the creation of finite element solvers. Chapters in Part II address the design and implementation of the FEnicS software. Chapters in Part III present the application of FEniCS to a wide range of applications, including fluid flow, solid mechanics, electromagnetics and geophysics.

The aim of this major reference work is to provide a first point of entry to the literature for the researchers in any field relating to structural integrity in the form of a definitive research/reference tool which links the various sub-disciplines that comprise the whole of structural integrity. Special emphasis will be given to the interaction between mechanics and materials and structural integrity applications. Because of the interdisciplinary and applied nature of the work, it will be of interest to mechanical engineers and materials scientists from both academic and industrial backgrounds including bioengineering, interface engineering and nanotechnology. The scope of this work encompasses, but is not restricted to: fracture mechanics, fatigue, creep, materials, dynamics, environmental degradation, numerical methods, failure mechanisms and damage mechanics, interfacial fracture and nano-technology, structural analysis, surface behaviour and heart valves. The structures under consideration include: pressure vessels and piping, off-shore structures, gas installations and pipelines, chemical plants, aircraft, railways, bridges, plates and shells, electronic circuits, interfaces, nanotechnology, artificial organs, biomaterial prostheses, cast structures, mining... and more. Case studies will form an integral part of the work.
This book is a result of many years' interest in the economic theory of pro duction, first aroused by the reading of Professor ERICH SCHNEIDER'S classic Theorie der Produktion. A grant from the Danish-Norwegian Foundation made it possible for me to spend six months at the Institute of Economics, University of Oslo, where I became acquainted with Professor RAGNAR FRISCH'S penetrating pioneer works in this field and where the plan of writing the present book was conceived. Further studies as a Rockefeller fellow at several American univer sities, especially an eight months' stay at the Harvard Economic Research Pro ject, and a visit to the Unione Industriale di Torino have given valuable impulses. For these generous grants, and for the help and advice given by the various institutions I have visited, I am profoundly grateful. My sincere thanks are also due to the University of Copenhagen for the ex ceptionally favourable working conditions which I have enjoyed there, and to the Institute of Economics-especially its director, Professor P. N0RREGAARD RASMUSsEN-for patient and encouraging interest in my work. I also wish to thank the Institute's office staff, Miss G. SUENSON and Mrs. G. STEN0R, for their constant helpfulness, and Mrs. E. HAUGEBO for her efficient work in preparing the manuscript, which was completed in the spring of 1965.
The analysis of singular perturbed differential equations began early in this century, when approximate solutions were constructed from asymptotic ex pansions. (Preliminary attempts appear in the nineteenth century [vD94].) This technique has flourished since the mid-1960s. Its principal ideas and methods are described in several textbooks. Nevertheless, asymptotic ex pansions may be impossible to construct or may fail to simplify the given problem; then numerical approximations are often the only option. The systematic study of numerical methods for singular perturbation problems started somewhat later - in the 1970s. While the research frontier has been steadily pushed back, the exposition of new developments in the analysis of numerical methods has been neglected. Perhaps the only example of a textbook that concentrates on this analysis is [DMS80], which collects various results for ordinary differential equations, but many methods and techniques that are relevant today (especially for partial differential equa tions) were developed after 1980.Thus contemporary researchers must comb the literature to acquaint themselves with earlier work. Our purposes in writing this introductory book are twofold. First, we aim to present a structured account of recent ideas in the numerical analysis of singularly perturbed differential equations. Second, this important area has many open problems and we hope that our book will stimulate further investigations.Our choice of topics is inevitably personal and reflects our own main interests.
This book constitutes the thoroughly refereed post-proceedings of the 7th International Conference on High Performance Computing for Computational Science, VECPAR 2006, held in Rio de Janeiro, Brazil, in June 2006. The 44 revised full papers presented together with one invited paper and 12 revised workshop papers cover Grid computing, cluster computing, numerical methods, large-scale simulations in Physics, and computing in Biosciences.

This book provides a basic introduction to reduced basis (RB) methods for problems involving the repeated solution of partial differential equations (PDEs) arising from engineering and applied sciences, such as PDEs depending on several parameters and PDE-constrained optimization. The book presents a general mathematical formulation of RB methods, analyzes their fundamental theoretical properties, discusses the related algorithmic and implementation aspects, and highlights their built-in algebraic and geometric structures. More specifically, the authors discuss alternative strategies for constructing accurate RB spaces using greedy algorithms and proper orthogonal decomposition techniques, investigate their approximation properties and analyze offline-online decomposition strategies aimed at the reduction of computational complexity. Furthermore, they carry out both a priori and a posteriori error analysis. The whole mathematical presentation is made more stimulating by the use of representative examples of applicative interest in the context of both linear and nonlinear PDEs. Moreover, the inclusion of many pseudocodes allows the reader to easily implement the algorithms illustrated throughout the text. The book will be ideal for upper undergraduate students and, more generally, people interested in scientific computing. All these pseudocodes are in fact implemented in a MATLAB package that is freely available at https://github.com/redbkit
The papers in this volume were selected for presentation at the 19th International Meshing Roundtable (IMR), held October 3–6, 2010 in Chattanooga, Tennessee, USA. The conference was started by Sandia National Laboratories in 1992 as a small meeting of organizations striving to establish a common focus for research and development in the field of mesh generation. Now after 19 consecutive years, the International Meshing Roundtable has become recognized as an international focal point annually attended by researchers and developers from dozens of co- tries around the world. The 19th International Meshing Roundtable consists of technical presentations from contributed papers, research notes, keynote and invited talks, short course presentations, and a poster session and competition. The Program Committee would like to express its appreciation to all who participate to make the IMR a successful and enriching experience. The papers in these proceedings were selected by the Program Committee from among numerous submissions. Based on input from peer reviews, the committee selected these papers for their perceived quality, originality, and appropriateness to the theme of the International Meshing Roundtable. We would like to thank all who submitted papers. We would also like to thank the colleagues who provided reviews of the submitted papers. The names of the reviewers are acknowledged in the following pages. We extend special thanks to Jacqueline Hunter for her time and effort to make the 19th IMR another outstanding conference.
This volume contains the texts of the four series of lectures presented by B.Cockburn, C.Johnson, C.W. Shu and E.Tadmor at a C.I.M.E. Summer School. It is aimed at providing a comprehensive and up-to-date presentation of numerical methods which are nowadays used to solve nonlinear partial differential equations of hyperbolic type, developing shock discontinuities. The most effective methodologies in the framework of finite elements, finite differences, finite volumes spectral methods and kinetic methods, are addressed, in particular high-order shock capturing techniques, discontinuous Galerkin methods, adaptive techniques based upon a-posteriori error analysis.
This book provides a solid introduction to the foundation and the application of the finite element method in structural analysis. It offers new theoretical insight and practical advice. This second edition contains additional sections on sensitivity analysis, on retrofitting structures, on the Generalized FEM (X-FEM) and on model adaptivity. An additional chapter treats the boundary element method, and related software is available at www.winfem.de.

This book introduces readers to one of the first methods developed for the numerical treatment of boundary value problems on polygonal and polyhedral meshes, which it subsequently analyzes and applies in various scenarios. The BEM-based finite element approaches employs implicitly defined trial functions, which are treated locally by means of boundary integral equations. A detailed construction of high-order approximation spaces is discussed and applied to uniform, adaptive and anisotropic polytopal meshes. The main benefits of these general discretizations are the flexible handling they offer for meshes, and their natural incorporation of hanging nodes. This can especially be seen in adaptive finite element strategies and when anisotropic meshes are used. Moreover, this approach allows for problem-adapted approximation spaces as presented for convection-dominated diffusion equations. All theoretical results and considerations discussed in the book are verified and illustrated by several numerical examples and experiments. Given its scope, the book will be of interest to mathematicians in the field of boundary value problems, engineers with a (mathematical) background in finite element methods, and advanced graduate students.
This latest volume in the Wavelets Analysis and Its Applications Series provides significant and up-to-date insights into recent developments in the field of wavelet constructions in connection with partial differential equations. Specialists in numerical applications and engineers in a variety of fields will find Multiscale Wavelet for Partial Differential Equations to be a valuable resource. Covers important areas of computational mechanics such as elasticity and computational fluid dynamics Includes a clear study of turbulence modeling Contains recent research on multiresolution analyses with operator-adapted wavelet discretizations Presents well-documented numerical experiments connected with the development of algorithms, useful in specific applications
Mathematics of Computing -- General.
The articles in this volume summarize the research results obtained in the former SFB 359 "Reactive Flow, Diffusion and Transport" which has been supported by the DFG over the period 1993-2004. The main subjects are physical-chemical processes sharing the difficulty of interacting diffusion, transport and reaction which cannot be considered separately. The modeling and simulation within this book is accompanied by experiments.

Computing application to materials science is one of the fastest--growing research areas. This book introduces the concepts and methodologies related to the modeling of the complex phenomena occurring in materials processing. It is intended for undergraduate and graduate students in materials science and engineering, mechanical engineering and physics, and for engineering professionals or researchers.
Assumptions about how people form expectations for the future shape the properties of any dynamic economic model. To make economic decisions in an uncertain environment people must forecast such variables as future rates of inflation, tax rates, governme.
This volume presents a selection of expository papers on various topics in engineering mathematics. The papers concern model problems relating to, amongst others, the automobile and shipping industries, transportation networks and wave propagation. Among the methods treated are numerical methods, such as the finite element method and Newton's method, Karmarkar's interior point method and generalizations, and recurrence and induction in computer science. This volume will be of great interest to applied mathematicians, physicists and engineers interested in recent developments in engineering mathematics. The papers are written with an emphasis on exposition and should be accessible to all members of scientific community interested in modeling and solving real-life problems.
In the recent decades, computational procedures have been applied to an increasing extent in engineering and the physical sciences. Mostly, two separate fields have been considered, namely, the analysis of solids and structures and the analysis of fluid flows. These continuous advances in analyses are of much interest to physicists, mathematicians and in particular, engineers. Also, computational fluid and solid mechanics are no longer treated as entirely separate fields of applications, but instead, coupled fluid and solid analysis is being pursued. The objective of the Book Series is to publish monographs, textbooks, and proceedings of conferences of archival value, on any subject of computational fluid dynamics, computational solid and structural mechanics, and

computational multi-physics dynamics. The publications are written by and for physicists, mathematicians and engineers and are to emphasize the modeling, analysis and solution of problems in engineering.

Numerical Methods for Partial Differential Equations: An Introduction Vitoriano Ruas, Sorbonne Universités, UPMC - Université Paris 6, France A comprehensive overview of techniques for the computational solution of PDE's Numerical Methods for Partial Differential Equations: An Introduction covers the three most popular methods for solving partial differential equations: the finite difference method, the finite element method and the finite volume method. The book combines clear descriptions of the three methods, their reliability, and practical implementation aspects. Justifications for why numerical methods for the main classes of PDE's work or not, or how well they work, are supplied and exemplified. Aimed primarily at students of Engineering, Mathematics, Computer Science, Physics and Chemistry among others this book offers a substantial insight into the principles numerical methods in this class of problems are based upon. The book can also be used as a reference for research work on numerical methods for PDE's. Key features: • A balanced emphasis is given to both practical considerations and a rigorous mathematical treatment. • The reliability analyses for the three methods are carried out in a unified framework and in a structured and visible manner, for the basic types of PDE's. • Special attention is given to low order methods, as practitioner's overwhelming default options for everyday use. • New techniques are employed to derive known results, thereby simplifying their proof. • Supplementary material is available from a companion website.