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| Autore | Solin Pavel |
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| Nota di contenuto | Partial Differential Equations and the Finite Element Method; CONTENTS; List of Figures; LIST OF FIGURES; List of Tables; LIST OF TABLES; Preface; Acknowledgments; 1 Partial Differential Equations; 1.1 Selected general properties; 1.1.1 Classification and examples; 1.1.2 Hadamard's well-posedness; 1.1 Jacques Salomon Hadamard ( 1865-1963).; 1.2 Isolines of the solution u(x, t ) of Burger's equation.; 1.1.3 General existence and uniqueness results; 1.1.4 Exercises; 1.2 Second-order elliptic problems; 1.2.1 Weak formulation of a model problem<br>1.3 Johann Peter Gustav Lejeune Dirichlet (1805-1859).1.2.2 Bilinear forms, energy norm, and energetic inner product; 1.2.3 The Lax-Milgram lemma; 1.2.4 Unique solvability of the model problem; 1.2.5 Nonhomogeneous Dirichlet boundary conditions; 1.2.6 Neumann boundary conditions; 1.2.7 Newton (Robin) boundary conditions; 1.2.8 Combining essential and natural boundary conditions; 1.2.9 Energy of elliptic problems; 1.2.10 Maximum principles and well-posedness; 1.4 Maximum principle for the Poisson equation in 2D.; 1.2.11 Exercises;<br>1.3 Second-order parabolic problems |

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1.5.5 Nonlinear flux and shock formation1.5.6 Exercises; 1.7 Formation of shock in the solution u(x, t ) of Burger's equation.; 2 Continuous Elements for 1D Problems; 2.1 The general framework; 2.1.1 The Galerkin method; 2.1 Boris Grigorievich Galerkin (1871-1945).; 2.1.2 Orthogonality of error and Cea's lemma; 2.1.3 Convergence of the Galerkin method; 2.1.4 Ritz method for symmetric problems; 2.1.5 Exercises; 2.2 Lowest-order elements; 2.2.1 Model problem; 2.2.2 Finite-dimensional subspace Vn C V; 2.2.3 Piecewise-affine basis functions; 2.2.4 The system of linear algebraic equations
2.2 Example of a basis function vi of the space Vn2.2.5 Element-by-element assembling procedure; 2.3 Tridiagonal stiffness matrix Sn.; 2.2.6 Refinement and convergence; 2.2.7 Exercises; 2.3 Higher-order numerical quadrature; 2.3.1 Gaussian quadrature rules; 2.4 Carl Friedrich Gauss (1777-1855).; 2.3.2 Selected quadrature constants; 2.1 Gaussian quadrature on Ka, order 2k - 1 = 3.; 2.2 Gaussian quadrature on Ka, order 2k - 1 = 5.; 2.3 Gaussian quadrature on Ka, order 2k - 1 = 7.; 2.4 Gaussian quadrature on Ka, order 2k - 1 = 9.; 2.5 Gaussian quadrature on Ka, order 2k - 1 = 11.
2.3.3 Adaptive quadrature

Sommario/riassunto

A systematic introduction to partial differentialequations and modern finite element methods for their efficient numerical solutionPartial Differential Equations and the Finite Element Method provides a much-needed, clear, and systematic introduction to modern theory of partial differential equations (PDEs) and finite element methods (FEM). Both nodal and hierachic concepts of the FEM are examined. Reflecting the growing complexity and multiscale nature of current engineering and scientific problems, the author emphasizes higher-order finite element methods such as the spectral