



#### 图书基本信息

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### 内容概要

This definitive introduction to finite element methods has been thoroughly updated for this third edition, which features important new material for both research and application of the finite element method.

The discussion of saddle point problems is a lughlight of the book and has been elaborated to include many more nonstandard applications. The chapter on applications in elasticity now contains a complete discussion of locking phenomena.

The numerical solution of elliptic partial differential equations is an important application of finite elements and the author discusses this subject comprehensively. These equations are treated as variational problems for which the Sobolev spaces are the right framework. Graduate students who do not necessarily have any particular background in differential equations but require an introduction to finite element methods will find this text invaluable. Specifically, the chapter on finite elements in solid mechanics provides a bridge between mathematics and engineering.





### 书籍目录

Preface to the Third English Edition Preface to the First English Edition Preface to the German Edition Notation Chapter Introduction 1. Examples and Classification of PDE's Examples **Classification of PDE's** Well-posed problems Problems 2. The Maximum Ptinciple Examples Corollaries Problem 3. Finite Difference Methods Discretization Discrete maximum principle Problem 4. A Convergence Theory for Difference Methods Consistency Local and global error Limits of the con-vergence theory **Ptoblems** Chapter **Conforming Finite Elements** 1. Sobolev Spaces Introduction to Sobolev spaces Friedrichs' inequality Possible singularities of H1 functions Compact imbeddings Problems 2. Variational Formulation of Elliptic Boundary-Value Problems of Second Order Variational formulation Reduction to homogeneous bound- ary conditions Existence of solutions Inhomogeneous boundary conditions Problems 3. The Neumann Boundary-Value Problem. A Trace Theorem Ellipticity in H Boundary-value problems with natural bound-ary conditions Neumann boundary conditions Mixed boundary conditions Proof of the trace theorem Practi- cal consequences of the trace theorem Problems

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4. The Ritz-Galerkin Method and Some Finite Elements Model problem Problems 5. Some Standard Finite Elements Requirements on the meshes Significance of the differentia-bility properties Triangular elements with complete polyno-mials **Remarks on CI elements** Bilinear elements Quadratic rectangular elements Affine families Choiceof an element Problems 6. Approximation Properties The Bramble-Hilbert lemma Triangular elements with com-plete polynomials Bilinear quadrilateral elements In-verse estimates Clement's interpolation Appendix: On the optimality of the estimates Problems 7. Error Bounds for Elliptic Problems of Second Order Remarks on regularity Error bounds in the energy normL2 estimates A simple Loo estimate The L2-projector Problems 8. Computational Considerations Assembling the stiffness matrix Static condensation Complexity of setting up the matrix Effect on the choice of a grid Local mesh refinement Implementation of the Neumann boundary-value problem Problems Nonconforming and Other Methods Chapter 1. Abstract Lemmas and a Simple Boundary Approximation Generalizations of Cea's lemma Duality methods The Crouzeix-Raviart element A simple approximation to curved boundaries Modifications of the duality argument Problems 2. Isoparametric Elements Isoparametric triangular elements Isoparametric quadrilateral elements Problems

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3. Further Tools from Functional Analysis Negative norms
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An abstract exis- tence theorem
An abstract convergence theorem
Proof of Theorem 3.4
Problems
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The inf-sup condition
Mixed finite element methods
Fortin interpolation

| Chapter | The Conjugate Gradient Method      |
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