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This book offers an in-depth presentation of the finite element method, aimed at engineers, students and researchers in applied sciences. The description of the method is presented in such a way as to be usable in any domain of application. The level of mathematical expertise required is limited to differential and matrix calculus. The various stages necessary for the implementation of the method are clearly identified, with a chapter given over to each one: approximation, construction of the integral forms, matrix organization, solution of the algebraic systems and architecture of programs. The final chapter lays the foundations for a general program, written in Matlab, which can be used to solve problems that are linear or otherwise, stationary or transient, presented in relation to applications stemming from the domains of structural mechanics, fluid mechanics and heat transfer.

An insight into the use of the finite method in geotechnical engineering. The first volume covers the theory and the second volume covers the applications of the subject. The work examines popular constitutive models, numerical techniques and case studies.

New and Improved SI Edition—Uses SI Units Exclusively in the Text Adapting to the changing nature of the engineering profession, this third edition of Fundamentals of Machine Elements aggressively delves into the fundamentals and design of machine elements with an SI version. This latest edition includes a plethora of pedagogy, providing a greater understanding of theory and design. Significantly Enhanced and Fully Illustrated The material has been organized to aid students of all levels in design synthesis and analysis approaches, to provide guidance through design procedures for synthesis issues, and to expose readers to a wide variety of machine elements. Each chapter contains a quote and photograph related to the chapter as well as case studies, examples, design procedures, an abstract, list of symbols and subscripts, recommended readings, a summary of equations, and end-of-chapter problems. What's New in the Third Edition: Covers life cycle engineering Provides a description of the hardness and common hardness tests Offers an inclusion of flat groove stress concentration factors Adds the staircase method for determining endurance limits and includes Haigh diagrams to show the effects of mean stress Discusses typical surface finishes in machine elements and manufacturing processes used to produce them Presents a new treatment of spline, pin, and retaining ring design, and a new section on the design of shaft couplings Reflects the latest International Standards Organization standards Simplifies the geometry factors for bevel gears Includes a design synthesis approach for worm gears Expands the discussion of fasteners and welds Discusses the importance of the heat affected zone for weld quality Describes the classes of welds and their analysis methods Considers gas springs and wave springs Contains the latest standards and manufacturer's recommendations on belt design, chains, and wire ropes The text also expands the appendices to include a wide variety of material properties, geometry factors for fracture analysis, and new summaries of beam deflection.

In the years since the fourth edition of this seminal work was published, active research has developed the Finite Element Method into the pre-eminent tool for the modelling of physical systems. Written by the pre-eminent professors in their fields, this new edition of the Finite Element Method maintains the comprehensive style of the earlier editions and authoritatively incorporates the latest developments of this dynamic field. Expanded to three volumes the book now covers the basis of the method and its application to advanced solid mechanics and also advanced fluid dynamics. Volume Two: Solid and Structural Mechanics is intended for readers studying structural mechanics at a higher level. Although it is an ideal companion volume to Volume One: The Basis, this advanced text also functions as a "stand-alone" volume,

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accessible to those who have been introduced to the Finite Element Method through a different route. Volume 1 of the Finite Element Method provides a complete introduction to the method and is essential reading for undergraduates, postgraduates and professional engineers. Volume 3 covers the whole range of fluid dynamics and is ideal reading for postgraduate students and professional engineers working in this discipline. Coverage of the concepts necessary to model behaviour, such as viscoelasticity, plasticity and creep, as well as shells and plates. Up-to-date coverage of new linked interpolation methods for shell and plate formations. New material on non-linear geometry, stability and buckling of structures and large deformations.

Developed from the authors, combined total of 50 years undergraduate and graduate teaching experience, this book presents the finite element method formulated as a general-purpose numerical procedure for solving engineering problems governed by partial differential equations. Focusing on the formulation and application of the finite element method through the integration of finite element theory, code development, and software application, the book is both introductory and self-contained, as well as being a hands-on experience for any student. This authoritative text on Finite Elements: Adopts a generic approach to the subject, and is not application specific In conjunction with a web-based chapter, it integrates code development, theory, and application in one book Provides an accompanying Web site that includes ABAQUS Student Edition, Matlab data and programs, and instructor resources Contains a comprehensive set of homework problems at the end of each chapter Produces a practical, meaningful course for both lecturers, planning a finite element module, and for students using the text in private study. Accompanied by a book companion website housing supplementary material that can be found at <http://www.wileyurope.com/college/Fish> A First Course in Finite Elements is the ideal practical introductory course for junior and senior undergraduate students from a variety of science and engineering disciplines. The accompanying advanced topics at the end of each chapter also make it suitable for courses at graduate level, as well as for practitioners who need to attain or refresh their knowledge of finite elements through private study.

STRUCTURAL ANALYSIS WITH THE FINITE ELEMENT METHOD Linear Statics Volume 1 : The Basis and Solids Eugenio Oñate The two volumes of this book cover most of the theoretical and computational aspects of the linear static analysis of structures with the Finite Element Method (FEM). The content of the book is based on the lecture notes of a basic course on Structural Analysis with the FEM taught by the author at the Technical University of Catalonia (UPC) in Barcelona, Spain for the last 30 years. Volume 1 presents the basis of the FEM for structural analysis and a detailed description of the finite element formulation for axially loaded bars, plane elasticity problems, axisymmetric solids and general three dimensional solids. Each chapter describes the background theory for each structural model considered, details of the finite element formulation and guidelines for the application to structural engineering problems. The book includes a chapter on miscellaneous topics such as treatment of inclined supports, elastic foundations, stress smoothing, error estimation and adaptive mesh refinement techniques, among others. The text concludes with a chapter on the mesh generation and visualization of FEM results. The book will be useful for students approaching the finite element analysis of structures for the first time, as well as for practising engineers interested in the details of the formulation and performance of the different finite elements for practical structural analysis. STRUCTURAL ANALYSIS

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WITH THE FINITE ELEMENT METHOD Linear Statics Volume 2: Beams, Plates and Shells Eugenio Oñate The two volumes of this book cover most of the theoretical and computational aspects of the linear static analysis of structures with the Finite Element Method (FEM). The content of the book is based on the lecture notes of a basic course on Structural Analysis with the FEM taught by the author at the Technical University of Catalonia (UPC) in Barcelona, Spain for the last 30 years. Volume 2 presents a detailed description of the finite element formulation for analysis of slender and thick beams, thin and thick plates, folded plate structures, axisymmetric shells, general curved shells, prismatic structures and three dimensional beams. Each chapter describes the background theory for each structural model considered, details of the finite element formulation and guidelines for the application to structural engineering problems Emphasis is put on the treatment of structures with layered composite materials. The book will be useful for students approaching the finite element analysis of beam, plate and shell structures for the first time, as well as for practising engineers interested in the details of the formulation and performance of the different finite elements for practical structural analysis.

This textbook offers theoretical and practical knowledge of the finite element method. The book equips readers with the skills required to analyze engineering problems using ANSYS®, a commercially available FEA program. Revised and updated, this new edition presents the most current ANSYS® commands and ANSYS® screen shots, as well as modeling steps for each example problem. This self-contained, introductory text minimizes the need for additional reference material by covering both the fundamental topics in finite element methods and advanced topics concerning modeling and analysis. It focuses on the use of ANSYS® through both the Graphics User Interface (GUI) and the ANSYS® Parametric Design Language (APDL). Extensive examples from a range of engineering disciplines are presented in a straightforward, step-by-step fashion. Key topics include: □ An introduction to FEM □ Fundamentals and analysis capabilities of ANSYS® □ Fundamentals of discretization and approximation functions □ Modeling techniques and mesh generation in ANSYS® □ Weighted residuals and minimum potential energy □ Development of macro files □ Linear structural analysis □ Heat transfer and moisture diffusion □ Nonlinear structural problems □ Advanced subjects such as submodeling, substructuring, interaction with external files, and modification of ANSYS®-GUI Electronic supplementary material for using ANSYS® can be found at <http://link.springer.com/book/10.1007/978-1-4899-7550-8>. This convenient online feature, which includes color figures, screen shots and input files for sample problems, allows for regeneration on the reader's own computer. Students, researchers, and practitioners alike will find this an essential guide to predicting and simulating the physical behavior of complex engineering systems."

Extended Finite Element and Meshfree Methods provides an overview of, and investigates, recent developments in extended finite elements with a focus on applications to material failure in statics and dynamics. This class of methods is ideally suited for applications, such as crack propagation, two-phase flow, fluid-structure-interaction, optimization and inverse analysis because they do not require any remeshing. These methods include the original extended finite element method, smoothed extended finite element method (XFEM), phantom node method, extended meshfree methods, numerical manifold method and extended isogeometric analysis. This book also addresses their implementation and provides small MATLAB codes on each sub-topic. Also discussed are the challenges and efficient algorithms for tracking the crack path which plays an important role for complex engineering applications. Explains all the important theory behind XFEM and meshfree methods Provides advice on how to implement XFEM for a range of practical purposes, along with helpful MATLAB codes Draws on the latest

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research to explore new topics, such as the applications of XFEM to shell formulations, and extended meshfree and extended isogeometric methods Introduces alternative modeling methods to help readers decide what is most appropriate for their work

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