1. Record Nr. UNINA9910132174803321

Autore	Carrera Erasmo
Titolo	Finite element analysis of structures through unified formulation / / Erasmo Carrera [and three others]
Pubbl/distr/stampa	Chichester, England : , : Wiley, , 2014 ©2014
ISBN	1-118-53665-7 1-118-53664-9 1-118-53666-5
Descrizione fisica	1 online resource (412 p.)
Disciplina	518/.25
Soggetti	Finite element method Numerical analysis
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references at the end of each chapters and index.
Nota di contenuto	Finite Element Analysis of Structures Through Unified Formulation; Contents; About the Authors; Preface; Nomenclature and Acronyms; Symbols; Acronyms; 1 Introduction; 1.1 What is in this Book; 1.2 The Finite Element Method; 1.2.1 Approximation of the Domain; 1.2.2 The Numerical Approximation; 1.3 Calculation of the Area of a Surface with a Complex Geometry via the FEM; 1.4 Elasticity of a Bar; 1.5 Stiffness Matrix of a Single Bar; 1.6 Stiffness Matrix of a Bar via the PVD; 1.7 Truss Structures and Their Automatic Calculation by Means of the FEM; 1.8 Example of a Truss Structure 1.8.1 Element Matrices in the Local Reference System1.8.2 Element Matrices in the Global Reference System; 1.8.3 Global Structure Stiffness Matrix Assembly; 1.8.4 Application of Boundary Conditions and the Numerical Solution; 1.9 Outline of the Book Contents; References; 2 Fundamental Equations of 3D Elasticity; 2.1 Equilibrium Conditions; 2.2 Geometrical Relations; 2.3 Hooke's Law; 2.4 Displacement Formulation; Further Reading; 3 From 3D Problems to 2D and 1D Problems: Theories for Beams, Plates and Shells; 3.1 Typical Structures; 3.1.1 Three-Dimensional Structures (Solids)

3.1.2 Two-Dimensional Structures (Plates, Shells and Membranes)3.1.3 One-Dimensional Structures (Beams and Bars); 3.2 Axiomatic Method; 3.2.1 Two-Dimensional Case; 3.2.2 One-Dimensional Case; 3.3 Asymptotic Method; Further Reading; 4 Typical FE Governing Equations and Procedures; 4.1 Static Response Analysis; 4.2 Free Vibration Analysis; 4.3 Dynamic Response Analysis; References; 5 Introduction to the Unified Formulation; 5.1 Stiffness Matrix of a Bar and the Related FN; 5.2 Case of a Bar Element with Internal Nodes; 5.2.1 The Case of Bar with Three Nodes
5.2.2 The Case of an Arbitrary Defined Number of Nodes5.3 Combination of the FEM and the Theory of Structure Approximations: A Four-Index FN and the CUF; 5.3.1 FN for a 1D Element with a Variable Axial Displacement over the Cross-section; 5.3.2 FN for a 1D Structure with a Complete Displacement Field: The Case of a Refined Beam Model; 5.4 CUF Assembly Technique; 5.5 CUF as a Unique Approach for 1D, 2D and 3D Structures; 5.6 Literature Review of the CUF; References; 6 The Displacement Approach via the PVD and FN for 1D, 2D and 3D Elements
6.1 Strong Form of the Equilibrium Equations via the PVD6.1.1 The Two Fundamental Terms of the FN; 6.2 Weak Form of the Solid Model Using the PVD; 6.3 Weak Form of a Solid Element Using Index Notation; 6.4 FN for 1D, 2D and 3D Problems in Unique Form; 6.4.1 Three-Dimensional Models; 6.4.2 Two-Dimensional Models; 6.4.3 One-Dimensional Models; 6.5 CUF at a Glance; References; 7 Three-Dimensional FEM Formulation (Solid Elements); 7.1 An Eight-Node Element Using Classical Matrix Notation; 7.1.1 Stiffness Matrix; 7.1.2 Load Vector; 7.2 Derivation of the Stiffness Matrix Using the Index Notation
7.2.1 Governing Equations

Sommario/riassunto

The finite element method (FEM) is a computational tool widely used to design and analyse complex structures. Currently, there are a number of different approaches to analysis using the FEM that vary according to the type of structure being analysed: beams and plates may use 1D or 2D approaches, shells and solids 2D or 3D approaches, and methods that work for one structure are typically not optimized to work for another. Finite Element Analysis of Structures Through Unified Formulation deals with the FEM used for the analysis of the mechanics of structures in the case of linea