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	Nota di contenuto	ANALYSIS AND DESIGN OF ELASTIC BEAMS; CONTENTS; PREFACE; 1 BEAMS IN BENDING; 1.1 Review of Linear Elasticity; 1.1.1 Kinematical Strain-Displacement Equations; 1.1.2 Material Law; 1.1.3 Equations of Equilibrium; 1.1.4 Surface Forces and Boundary Conditions; 1.1.5 Other Forms of the Governing Differential Equations; 1.2 Bending Stresses in a Beam in Pure Bending; 1.3 Principal Bending Axes; 1.4 Axial Loads; 1.5 Elasticity Solution for Pure Bending; References; 2 BEAM ELEMENTS; 2.1 Fundamental Engineering Theory Equations for a Straight Beam; 2.1.1 Geometry of Deformation 2.1.2 Force-Deformation Relations2.1.3 Equations of Equilibrium; 2.1.4 Boundary Conditions; 2.1.5 Displacement Form of the Governing Differential Equations; 2.1.6 Mixed Form of the Governing Differential Equations; 2.1.7 Principle of Virtual Work: Integral Form of the Governing Equations; 2.2 Response of Beam Elements; 2.2.1 First-Order Form of the Governing Equations; 2.2.2 Sign Conventions for Beams; 2.2.3 Definition of Stiffness Matrices; 2.2.4 Determination of Stiffness Matrices; 2.2.5 Development of an Element by Mapping from a

Reference Element; 2.3 Mass Matrices for Dynamic Problems

2.3.1 Consistent Mass Matrices2.3.2 Lumped Mass Matrices; 2.3.3 Exact Mass and Dynamic Stiffness Matrices; 2.4 Geometric Stiffness Matrices for Beams with Axial Loading; 2.5 Thermoelastic Analysis; References; 3 BEAM SYSTEMS; 3.1 Structural Systems; 3.1.1 Coordinate System and Degrees of Freedom; 3.1.2 Transformation of Forces and Displacements; 3.2 Displacement Method of Analysis; 3.2.1 Direct Stiffness Method; 3.2.2 Characteristics of the Displacement Method; 3.3 Transfer Matrix Method of Analysis; 3.4 Dynamic Responses; 3.4.1 Free Vibration Analysis; 3.4.2 Forced Response

3.5 Stability Analysis3.6 Analyses Using Exact Stiffness Matrices; References; 4 FINITE ELEMENTS FOR CROSS-SECTIONAL ANALYSIS; 4.1 Shape Functions; 4.2 Transformation of Derivatives and Integrals; 4.3 Integrals; 4.4 Cross-Sectional Properties; 4.5 Modulus-Weighted Properties; References; 5 SAINT-VENANT TORSION; 5.1 Fundamentals of Saint-Venant Torsion; 5.1.1 Force Formulation; 5.1.2 Membrane Analogy; 5.2 Classical Formulas for Thin-Walled Cross Sections; 5.2.1 Open Sections; 5.2.2 Closed Sections, Hollow Shafts; 5.3 Composite Cross Sections; 5.4 Stiffness Matrices

5.4.1 Principle of Virtual Work5.4.2 Weighted Residual Methods; 5.4.3 Isoparametric Elements; 5.5 Assembly of System Matrices; 5.6 Calculation of the Torsional Constant and Stresses; 5.7 Alternative Computational Methods; 5.7.1 Boundary Integral Equations; 5.7.2 Boundary Element Method; 5.7.3 Direct Integration of the Integral Equations; References; 6 BEAMS UNDER TRANSVERSE SHEAR LOADS; 6.1 Transverse Shear Stresses in a Prismatic Beam; 6.1.1 Approximate Shear Stress Formulas Based on Engineering Beam Theory; 6.1.2 Theory of Elasticity Solution; 6.1.3 Composite Cross Section

6.1.4 Finite Element Solution Formulation

| Sommario/riassunto | State-of-the-art coverage of modern computational methods for the analysis and design of beamsAnalysis and Design of Elastic Beams presents computer models and applications related to thin-walled beams such as those used in mechanical and aerospace designs, where thin, lightweight structures with high strength are needed. This book will enable readers to compute the cross-sectional properties of individual beams with arbitrary cross-sectional shapes, to apply a general-purpose computer analysis of a complete structure to determine the forces and moments in the individual members, and to us |