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Mechanical Stability Models; 2.1 Model A; A One-Degree-of-Freedom Model; 2.2 Model B; A One-Degree-of-Freedom Model; 2.3 Model C; A Two-Degree-of-Freedom Model; 2.4 Model D; A Snaphthrough Model; 2.5 Models of Imperfect Geometries; 2.6 Discussion of the Methods; 3 Elastic Buckling of Columns; 3.1 Special Functions; 3.2 Beam Theory; 3.3 Buckling of Columns
3.4 The Kinetic Approach3.5 Elastically Supported Columns; 3.6 Critical Spring Stiffness; 3.7 Elastica Theory for Beams; 3.8 Buckling of Thin-Walled Beam-Columns; 4 Buckling of Frames; 4.1 Beam-Column Theory; 4.2 Application of Beam-Column Theory to the Buckling of Rotationally Restrained Columns; 4.3 Rectangular Rigid Frames; 4.4 The Simply Supported Portal Frame; 4.5 Alternate Approach; 4.6 Nonlinear Analysis; 5 The Energy Criterion and Energy-Based Methods; 5.1 Remarks on the Energy Criterion; 5.2 Timoshenko's Method; 5.3 The Rayleigh-Ritz Method; 5.4 The Column by the Trefftz Criterion
5.5 The Galerkin Method5.6 Some Comments on Koiter's Theory; 6 Columns on Elastic Foundations; 6.1 Basic Considerations; 6.2 The Pinned-Pinned Column; 6.3 Rayleigh-Ritz Solution; 6.4 The General Case; 7 Buckling of Ring and Arches; 7.1 The Thin Circular Ring; 7.2 High Circular Arches Under Pressure; 7.3 Alternate Approach for Rings and Arches; 7.4 Shallow Arches; 7.5 The Sinusoidal Pinned Arch; 7.6 The Low Arch by the Trefftz Criterion; 7.7 Energy Formulation Based on Geometrically Exact Theory; 7.8 Alternative Formulation Based on Elastica Theory; 8 Buckling of Shafts
8.1 Perturbation Equations Governing Buckling8.2 Energy Approach; 8.3 Application of Forces and Moments-Boundary Conditions; 8.4 Example Problems; 9 Lateral-Torsional Buckling of Deep Beams; 9.1 Pinned-Pinned Beam; 9.2 Cantilevered Beam Under Bending Moment; 9.3 Cantilevered Beam Under Transverse Force; 10 Instabilities Associated with Rotating Beams; 10.1 Axial Instability of Radial Rods; 10.2 Buckling of Rotating Radial Beams; 11 Nonconservative Systems; 11.1 Preliminary Remarks; 11.2 Mechanical Follower Force Model; 11.3 Beck's Column; 11.4 Leipholz's Column
11.5 Cantilevered Shaft Subject to Tangential Torque11.6 Deep Cantilever with Transverse Follower Force at the Tip; 11.7 Fully Intrinsic Formulation for Beams; 12 Dynamic Stability; 12.1 Introduction and Fundamental Concepts; 12.2 The Total Potential Energy Approach: Concepts and Procedure; 12.3 Extension of the Dynamic Stability Concept; 12.4 Behavior of Suddenly Loaded Systems; 12.5 Simple Mechanical Models; back matter; Appendix: Work and Energy-Related Principles and Theorems; A.1 Strain Energy; A.2 The Principle of Virtual Displacement or Virtual Work
A.3 Derivatives of the Principle of Virtual Work

Sommario/riassunto

The ability of a structural assembly to carry loads and forces determines how stable it will be over time. Viewing structural assemblages as comprising columns, beams, arches, rings, and plates, this book will introduce the student to both a classical and advanced understanding of the mechanical behavior of such structural systems under load and how modeling the resulting strains can predict the overall future performance-the stability-of that structure. While covering traditional beam theory, the book is more focused on elastica theory in keeping with modern approaches. This text will be
