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| Nota di contenuto | Vibrations and Waves in Continuous Mechanical Systems; Contents; Preface; 1 Vibrations of strings and bars; 1.1 Dynamics of strings and bars: the Newtonian formulation; 1.1.1 Transverse dynamics of strings; 1.1.2 Longitudinal dynamics of bars; 1.1.3 Torsional dynamics of bars; 1.2 Dynamics of strings and bars: the variational formulation; 1.2.1 Transverse dynamics of strings; 1.2.2 Longitudinal dynamics of bars; 1.2.3 Torsional dynamics of bars; 1.3 Free vibration problem: Bernoulli's solution; 1.4 Modal analysis; 1.4.1 The eigenvalue problem; 1.4.2 Orthogonality of eigenfunctions; 1.4.3 The expansion theorem; 1.4.4 Systems with discrete elements; 1.5 The initial value problem: solution using Laplace transform; 1.6 Forced vibration analysis; 1.6.1 Harmonic forcing; 1.6.2 General forcing; 1.7 Approximate methods for continuous systems; 1.7.1 Rayleigh method; 1.7.2 Rayleigh-Ritz method; 1.7.3 Ritz method; 1.7.4 Galerkin method; 1.8 Continuous systems with damping; 1.8.1 Systems with distributed damping; 1.8.2 Systems with discrete damping; 1.9 Non-homogeneous |

boundary conditions; 1.10 Dynamics of axially translating strings;
 1.10.1 Equation of motion
 1.10.2 Modal analysis and discretization
 1.10.3 Interaction with discrete elements; Exercises; References; 2 One-dimensional wave equation: d'Alembert's solution; 2.1 D'Alembert's solution of the wave equation; 2.1.1 The initial value problem; 2.1.2 The initial value problem: solution using Fourier transform; 2.2 Harmonic waves and wave impedance; 2.3 Energetics of wave motion; 2.4 Scattering of waves; 2.4.1 Reflection at a boundary; 2.4.2 Scattering at a finite impedance; 2.5 Applications of the wave solution; 2.5.1 Impulsive start of a bar; 2.5.2 Step-forcing of a bar with boundary damping
 2.5.3 Axial collision of bars
 2.5.4 String on a compliant foundation; 2.5.5 Axially translating string; Exercises; References; 3 Vibrations of beams; 3.1 Equation of motion; 3.1.1 The Newtonian formulation; 3.1.2 The variational formulation; 3.1.3 Various boundary conditions for a beam; 3.1.4 Taut string and tensioned beam; 3.2 Free vibration problem; 3.2.1 Modal analysis; 3.2.2 The initial value problem; 3.3 Forced vibration analysis; 3.3.1 Eigenfunction expansion method; 3.3.2 Approximate methods; 3.4 Non-homogeneous boundary conditions
 3.5 Dispersion relation and flexural waves in a uniform beam
 3.5.1 Energy transport; 3.5.2 Scattering of flexural waves; 3.6 The Timoshenko beam; 3.6.1 Equations of motion; 3.6.2 Harmonic waves and dispersion relation; 3.7 Damped vibration of beams; 3.8 Special problems in vibrations of beams; 3.8.1 Influence of axial force on dynamic stability; 3.8.2 Beam with eccentric mass distribution; 3.8.3 Problems involving the motion of material points of a vibrating beam; 3.8.4 Dynamics of rotating shafts; 3.8.5 Dynamics of axially translating beams; 3.8.6 Dynamics of fluid-conveying pipes; Exercises
 References

Sommario/riassunto

The subject of vibrations is of fundamental importance in engineering and technology. Discrete modelling is sufficient to understand the dynamics of many vibrating systems; however a large number of vibration phenomena are far more easily understood when modelled as continuous systems. The theory of vibrations in continuous systems is crucial to the understanding of engineering problems in areas as diverse as automotive brakes, overhead transmission lines, liquid filled tanks, ultrasonic testing or room acoustics. Starting from an elementary level, Vibrations and Waves in Continuous Me
