

AE 6230 STRUCTURAL DYNAMICS

Introduction; modeling of discrete systems; review of linear system theory (3 hours)

Mathematical modeling of single-degree-of-freedom (SDOF) systems; equations and basic responses of SDOF systems (3 hours)

Response of SDOF systems to harmonic excitation (1.5 hours)

Viscous damping; structural damping; Coulomb damping (1.5 hours)

Laplace transforms; Harmonic balance; Fourier series; Fourier integral; convolution integral; Duhamel's integral (4.5 hours)

The Newtonian method (1.5 hours)

Work, energy, and Lagrange's equations (3 hours)

Matrix eigenvalue problems; qualitative aspects, nature of modes; response of multi-degree-of-freedom systems by modal decoupling; rigid-body modes (6 hours)

Stability; Kelvin-Tait-Chataev theorem (1.5 hours)

Rotor dynamics example (1.5 hours)

Hamilton's principle and calculus of variations (1.5 hours)

Extension and torsion of rods (3 hours)

Bending vibration of Euler-Bernoulli beams (3 hours)

Bending-shear vibration of Timoshenko beams (3 hours)

Strings revisited – the nonlinear nature of the problem (1.5 hours)

Beams with axial force, rotating beams, Beck's problem (1.5 hours)

Membranes and plates (1.5 hours)

Review/quizzes (3 hours)