Indian Institute of Science

Mechanical Engineering
Indian Institute of Science
Bengaluru, 560 012
India

E-mail: chair.me@iisc.ac.in
URL: www.mecheng.iisc.ac.in
Telephone: +91 (80) 2293 2332 (office)

ME 224 (JAN) 3:0
Mechanical Vibrations

Instructor(s): Jishnu Keshavan

Course description: Overview of linear dynamics. Hamilton's principle. Lagrangian formulation for multiple degrees-of-freedom systems. Eigenvalue problem, modal decomposition and analysis, natural modes and orthogonality, free and harmonic excitation response. Approximate solutions using Rayleigh-Ritz method, Galerkin approximation and assumed-modes method. Analysis of nonlinear dynamics. Characterization of nonlinearity, equilibrium and stability analysis of weakly nonlinear systems, bifurcations, limit cycles, Van der Pol oscillator, phase plane methods, perturbation approach, harmonic balance, averaging and multiple scales, free and forced response, subharmonic oscillations, jump phenomena. Applications in automotive, aerospace, biomedical, consumer products, and microelectromechanical systems.

Prerequisites: Linear algebra and programming experience in MATLAB are preferred. Familiarity with multivariable calculus is recommended.

Resources:

1. Instructor's notes.
2. L. Meirovitch, Fundamentals of Vibrations, McGraw-Hill, 2001.
3. Ali H. Nayfeh and B. Balachandran, Applied Nonlinear Dynamics, Wiley, 1995.

Outcomes:

Additional information: This course is open to doctoral and master's students interested in dynamics and control, structural mechanics and optimization. Undergraduate students with sufficient background can approach the instructor for permission.

Course website: