



THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Nonlinear Dynamics

MECHENG 8230

Credit Hours:

3.00 - 3.00

Course Levels:

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Analytical, geometric, and perturbation methods for study of nonlinear mechanical systems, and the dynamical phenomena that arise in nonlinear systems including stability, bifurcations, and hysteresis.

Prerequisites and Co-requisites:

Prereq: 7250 (731), or Grad standing in Engineering, or permission of instructor.

Course Goals / Objectives:

- Learn analytical, geometric, and perturbation methods for analyzing non-linear mechanical systems
- Examine nonlinear dynamic behavior including stability, bifurcations, and hysteresis
- Apply concepts to real-life non-linear problems

Course Topics:

- Introduction to the study of nonlinear mechanical systems, sources of nonlinearities, etc.
 - Qualitative theory of differential equations: linearization and linear stability, phase plane/space, basins of attraction, periodic motions including limit cycles, Poincare maps and discrete dynamical systems
 - Various analytical perturbations techniques for the study of (linear and nonlinear) systems: Linstedt-Poincare, harmonic balance, averaging, matched asymptotic, etc.
 - Vibrations of nonlinear mechanical systems, forced, unforced, damped, and parametrically excited systems.
 - Special topics: machine tool chatter, aeroelastic flutter, robot stability, stability of controlled dynamic systems, material and structural hysteresis, turbulence, etc.
 - Qualitative theory of differential equations: time-varying and time-invariant systems, nonlinear stability and structural stability, dependence on initial conditions, various bifurcations, etc.
-

Designation:

Elective