NOC:Introduction to Non Linear Dynamics - Video course

COURSE OUTLINE

This course is an introduction to nonlinear dynamics. We will employ a combination of analytical methods, examples, and geometric motivation. We will start with first order differential equations, and their bifurcations, and then move onto two dimensional flows.

COURSE DETAIL

A brief introduction to modelling:
Introduction to the course:
One dimensional flows:

Flows on the line

- Geometrical intuition
- Fixed points, and stability
- Local stability analysis
- Existence and Uniqueness
- Impossibility of Oscillations
- Potentials
- Numerical methods

Bifurcations

- Saddle node
- Normal forms
- Transcritical
- Pitch fork
- Imperfect bifurcations
- Example
- Numerics (XPP-Auto)

Flows on the circle

- Uniform oscillator
- Non-uniform oscillator

Two dimensional flows:

Linear systems

- Definitions and examples
- Classification of linear systems
- Dynamics of love affairs

NP-TEL

NPTEL

http://nptel.ac.in

Electrical Engineering

Pre-requisites:

Calculus and basic linear algebra

Coordinators:

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Phase plane

- Phase portraits
- Existence, uniqueness and topological consequences
- Fixed points and linearisation
- Examples: population dynamics

Limit cycles

- Ruling out closed orbits
- Poincare-Bendixson theorem
- Lienard systems
- Weakly nonlinear oscillators

Bifurcations

- Saddle-node, Transcritical and Pitchfork
- Choice of bifurcation parameter
- Hopf
- Poincare Maps

Final comments:

- Higher-order systems, and the existence of Chaos
- Importance of time delays and noise

References:

1. Nonlinear dynamics and Chaos, by Steven Strogatz
2. Simulating, Analyzing and Animating Dynamical Systems, by Bard Ermentrout