

SYLLABUS

1. Introduction

- linear versus nonlinear systems
- some mathematical preliminaries
 - topology in \mathbb{R} , compact sets, implicit function theorem)

2. Poincaré - Bendixson theory

- ω -limit sets
- periodic orbits and the Poincaré map
- Example: electronic oscillators - a simplified Lienard's equation

3. Elements of bifurcation theory

- examples - saddle-node, transcritical, pitch fork, ...
- normal forms
- Hopf-bifurcation theorem

4. Solutions to ordinary differential equations

- mathematical preliminaries - uniform convergence, metric spaces, ...
- existence and uniqueness results
- dependence of solutions on initial conditions and parameters
- differentiability of solutions with respect to initial conditions and parameters

5. Lyapunov stability for autonomous systems

- the main theorems (Lyapunov, Chetaev, LaSalle)
- linearization
- stable and unstable manifolds

6. Regions of attraction (just an introductory discussion)

7. Center manifold theory (tentative, subject to change)

- center manifold theorem
- reduction principle
- approximations of the center manifold