1. Linear systems $\dot{x} = Ax$:

- Diagonalization and Jordan representation
- Properties of operator exponentials
- Solution to IVP $\dot{x} = Ax, x(0) = x_0$, stability theory
- Fundamental matrices and nonhomogeneous systems

2. Nonlinear systems $\dot{x} = f(x,t)$ - local theory

- Fundamental Existence-Uniqueness theorem
- Dependence on initial data and parameters
- Maximal interval of existence
- Stability theory

3. Nonlinear systems - bifurcation theory, global theory

- Bifurcations at nonhyperbolic points
  - Saddle-node, transcritical, pitchfork bifurcations
  - Sotomayor theorem
  - Bifurcation diagrams
- Higher-codimension bifurcations and nonhyperbolic points
  - Universal unfolding
  - Cusp bifurcation
- Hopf bifurcations
- Attractors, limit sets and periodic orbits

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Material After Midterm

- Normal Form Theory
  - Reduction to normal form
- Classification of nonhyperbolic critical points in planar systems
- Gradient and Hamiltonian Systems
  - Hamiltonian systems, Newtonian systems
  - Classification of critical points