

1 Outline of the Course

1. Exponentiation of Matrices
2. Canonical forms of 2×2 matrices
3. Linear Systems of the form $x' = Ax$, $A \in M(2, \mathbb{R})$. Solutions, Qualitative behaviour of the trajectories in terms of eigen values, Vector fields, one-parameter groups of motions
4. Jordan canonical form of matrices
5. Application of the canonical form to the study of the linear systems
6. Matrix differential equations: $X' = AX$, $X, A \in M(n, \mathbb{R})$.
 - Generalities
 - Application to $x' = Ax$
 - Application to higher order scalar equations
 - Description of the solution space
 - Application of the last two items to enunciate an algorithm for finding e^A
7. Nonlinear System: Local existence, uniqueness, continuous dependence on the initial data and local (one-parameter) flow

Reference

Hirsch and Smale, *Dynamical Systems, Differential Equations and Linear Algebra*, Academic Press.