

**A. Agrachev, fall 2006.**  
**The course for the 2nd year Laurea magistrale**  
**and 1st year Ph.D. students**

1. Correctness of the Cauchy problem for systems of ordinary differential equations.
2. Regular and critical values of smooth mappings. The notion of transversality.
3. Sard's lemma. Generic properties.
4. Whitney embedding theorem.
5. Topological degree of a mapping.
6. Intersection number and linking number.
7. Index of a vector field on a smooth manifold.
8. Linearization of a vector field at an equilibrium. Phase portraits of linear systems.
9. Asymptotic stability of the equilibrium and Lyapunov functions.
10. Structural stability of the hyperbolic equilibria; the Grobman–Hartman theorem.
11. Asymptotic behavior of the solutions to two-dimensional systems. Characterization of the structurally stable two-dimensional phase portraits.