

Fall 2015  
MATH 83100: Topics in Dynamics [28621]  
Tues, 2pm-4pm Prof. E. Pujals 3 cr.

The goal is to present some basic topics in dynamical system using prototype examples that highlight typical dynamical behaviors. Through focusing in some examples we will discuss a dictionary between "a taxonomy of generic dynamical phenomenas" and a list of "simple mechanisms or dynamical configurations" responsible for such phenomenas.

In certain cases we will provide a quick glimpse on the subject without getting into details.

1. One-dimensional real dynamics

- (a) circle homeomorphisms and diffeomorphisms.
- (b) Rotation number; aperiodic dynamics and Morse-Smale; Arnold family.
- (c) Expanding endomorphisms.
- (d) Critical endomorphisms.
- (e) Stability results for one dimensional dynamics.
- (f) A short introduction to ergodic theory and what is possible to say in one dimensional dynamics.
- (g) Dynamics with zero entropy; Zharkoski and the boundary of zero entropy.
- (h) Quadratic family: stochastic and simple dynamics.
- (i) Few words on renormalization.
- (j) Newton's method.
- (k) A few words about one-dimensional complex dynamics.

2. Hyperbolic dynamics

- (a) A short introduction to hyperbolic dynamics through examples: the horseshoes, Anosov diffeomorphisms, Solenoid and other hyperbolic attractors.
- (b) The key features and ingredients in hyperbolic dynamics.
- (c) The stability conjecture and some results.

3. Beyond hyperbolic dynamics.

- (a) Homoclinic tangencies and Newhouse's phenomena on surfaces.
- (b) Non-uniform hyperbolicity on surfaces; Henon attractor.
- (c) Dominated splitting and Partially hyperbolic dynamics.
- (d) Blenders.
- (e) Robust transitivity and Stable ergodicity.
- (f) Phenomenas and mechanisms; typical homoclinic bifurcation on the complement of hyperbolic dynamics.

4. A few words on flows.

- (a) Anosov flows.
- (b) Geodesic flows on manifold with negative curvature.

- (c) Lorenz attractors.
5. A few words on conservative and Hamiltonian dynamics.
- (a) Some examples on Hamiltonian dynamics; the pendulum, two and many body problems.
  - (b) A glimpse into KAM theory.
  - (c) A very short introduction to Arnold's diffusion.