Continuous Dynamical Systems

Math 181 - Spring 2010

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The theory of continuous dynamical systems was developed largely in response to the reality that most nonlinear differential equations lack exact analytic solutions. In addition to being of interest in their own right, such nonlinear equations arise naturally as mathematical models from many disciplines including biology, chemistry, physiology, ecology, physics, and engineering. This course is an introduction to and survey of characteristic behavior of such dynamical systems. Applications will be an integral part of the course with examples including mechanical vibrations, biological rhythms, circuits, insect outbreaks, and chemical oscillations.

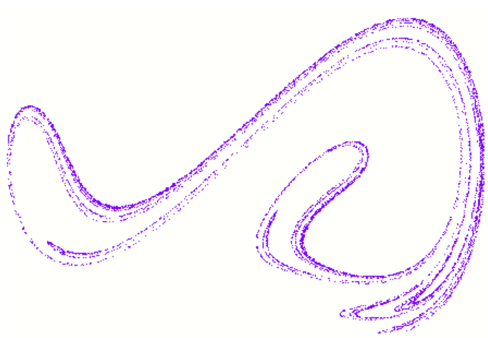
Sample topics include:

- ODE's on the line and circle (Fixed points, stability, bifurcations, oscillations)
- Systems of ODE's (Phase plane analysis, Jordan form, stable and unstable manifolds, fixed points and linearization, topological equivalence, , homoclinic & heteroclinic orbits)
- Closed Orbits (Poincaré-Bendixon theorem)
- Bifurcation Theory (Hopf bifurcation, bifurcations of closed orbits)
- Chaos Theory (Iterated Maps, Symbolic Dynamics)
- Strange Attractors (Smale Horseshoe, Lorenz Butterfly, Henon Attractor)

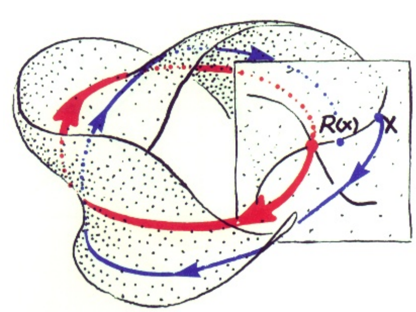
Text: S. Strogatz, *Nonlinear Dynamics & Chaos*

Class Time: MW 2:45 - 4:00pm, BK B134.

Prerequisites: Math 131, 115, or 180 or permission of the instructor.



Poincaré's Return Map



Poincaré Section of Strange Attractor