

Math 8502, 3 Credits, Spring 2009  
**Dynamical Systems and Differential Equations**

— *Syllabus* —

Arnd Scheel, VinH 251, phone 625-4065, scheel@math.umn.edu

**Time & Place** MWF 10:10 – 11:00, VinH 301

**Material Covered** The main theme of this course will be the dynamics of maps and diffeomorphisms. Our main focus will be on the description of *complicated* dynamics. We will start with the topological and combinatorial theory of one-dimensional maps, which will lead us to rotation numbers, kneading sequences, and Sarkovskii's theorem (also known as "Period 3 implies chaos"). We will then move on to the smooth theory of diffeomorphisms, where we will investigate hyperbolicity and its consequences. Examples will include Smale's horseshoe, homoclinic tangles, Arnol'd's cat map, and expanding interval maps. A first goal will be to establish true conjugacies to combinatorial (Markov) descriptions of the dynamics. We will also address limitations of the hyperbolic theory, and the prevalence of non-robust dynamics. The last part of the course will address statistical properties of deterministic dynamics, the existence of (smooth or physical) invariant measures, mixing, and decay of correlations.

Most of the course will be independent of Math 8501, but a solid background in analysis is required.

**Text** No textbook is required.

**Office Hours** MWF 11:10 – 12:00, VinH 251 or by appointment.

**Contact** All material regarding the course, in particular homework assignments, can be found on my homepage <http://www.math.umn.edu/~scheel>. Everybody is encouraged to ask questions at any time, best during or after the lecture, at office hours, or by appointment. Best way to reach me is email to [scheel@math.umn.edu](mailto:scheel@math.umn.edu).

**Projects** There will be no exams. Each student will be assigned a project and will have to turn in a report by the end of the semester.

**Homework** There will be monthly homework assignments.

**Composition of Grade** Homework 40%, Project 60%.