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Fall 9-1-2000

MATH 514.01: Topics in Applied Mathematics Dynamics - Asymptotics and Chaos - Introduction To Dynamical Systems

Leonid Kalachev

The University of Montana

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MATH 514 (3 cr.)

**MWF 12:10 – 1:00 p.m.
Room: MA103**

**Topics in Applied Mathematics
Dynamics, Asymptotics and Chaos: Introduction
To Dynamical Systems**

Syllabus (plus or minus...)

Instructor: Leonid Kalachev (leonid@selway.umt.edu, MA308, 243-4373)

Text: K.T. Alligood, T.D. Sauer and J.A. Yorke, *CHAOS: An Introduction to Dynamical Systems*, New York: Springer-Verlag, 1997.

The course will address the following topics: discrete and continuous dynamical systems, nonlinear differential equations and bifurcations, asymptotic reductions of large models formulated in terms of systems of differential equations, chaos and fractals. Relevant concepts from physical, chemical, and biological sciences will be discussed. Students will perform computer experiments to explore fundamental concepts related to the topic. Particular applications of the theory in various scientific fields will also be studied.

1. Elementary differential equations and bifurcations. Examples. (Ch.7; various sources.)
2. Difference equations: one-dimensional maps and bifurcations. (Ch.1, Ch.11.)
3. Chaos. Lyapunov exponents. Cascades. (Ch.3, Ch.12.)
4. Systems of differential equations. Periodic orbits and limit sets. (Ch.7, Ch.8; various sources.)
5. Reduction techniques for systems of differential equations. Slow manifolds. (Various sources.)
6. Chaos in differential equations. (Ch.9.)
7. Difference equations: two-dimensional maps. (Ch.2, parts of Ch.5, Ch.6, Ch.10.)
8. Fractals. (Ch.4.)
9. **If have time:** State reconstruction from data. (Ch.13.)

Several homework assignments will be given during the semester (20% of final grade); there will be two midterms (25% each) on Friday, Oct. 20, and on Friday, Dec.1, and a final exam (30%) during the finals week on Tuesday, Dec. 19 from 8:00 to 10:00 a.m.

Office hours: MWF 10:00 – 11:00 a.m.