Math 558 Applied Dynamical Systems Winter 2023

Dynamical systems theory provides tools for understanding complex behaviour in a broad range of applications. We will study continuous systems (differential equations) and discrete systems (iterated maps). The course aims to provide an overview of the subject as well as an in-depth analysis of specific examples. The topics include: bifurcations (saddle-node, transcritical, pitchfork, subcritical, supercritical, Hopf), stable and unstable manifolds, dissipative systems, attractors, logistic map, period-doubling, Feigenbaum sequence, renormalization, chaos, Lyapunov exponent, fractals, Cantor set, Hausdorff dimension, Lorenz system, nonlinear oscillations, quasiperiodicity, Hamiltonian systems, integrability, resonance, KAM tori, homoclinic intersections, Melnikov's method.

Instructor
Robert Krasny, 4830 East Hall, 763-3505, krasny@umich.edu

Class Time/Location
MW 11:30am-1pm, 4088 East Hall

Office Hours
MW 5-6:30pm, or email for an appointment, or just drop in when my door is open

Text
Nonlinear Systems, Philip G. Drazin, Cambridge University Press
PDFs of the chapters are freely available at the CUP website when accessed through a U-M computer. click here

Other References
Differential Dynamical Systems, James D. Meiss, SIAM
Chaos in Dynamical Systems, Edward Ott, Cambridge University Press
Nonlinear Differential Equations and Dynamical Systems, Ferdinand Verhulst, Springer
Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields,
John Guckenheimer and Philip Holmes, Springer

Prerequisites
advanced calculus, multivariable calculus, linear algebra, ordinary differential equations

Alternative
Math 404 covers similar topics at a more leisurely pace.

Grading
The course grade will be based on homework (50%), a midterm exam (20%), and a final exam (30%). The final exam is on Thursday, April 27, 1:30-3:30pm.