Math 572  Numerical Methods for Differential Equations  Winter 2019

Time: Tues/Thurs 11:30am-1pm, 3866 East Hall

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

Office Hours: Tues 4-6pm, Wed 3-4pm, and by appointment or just drop in

Course Website: http://www.math.lsa.umich.edu/~krasny/math572.html

Computer simulation is routinely used in science and engineering, and increasingly also in other fields such as finance and medicine. However, computer simulations can be challenging; using a faster computer is no guarantee of success and sometimes one must use a better algorithm. Math 572 is an introduction to numerical methods for differential equations. The course focuses on finite-difference schemes for initial value problems involving ordinary and partial differential equations. Theory and practical computing issues will be covered.

Prerequisites
advanced calculus, linear algebra, complex variables, Fourier series; Math 571 is not a prerequisite

Recommended Text

I’ll use my own lecture notes which will be posted on the course website, but this text is recommended for outside reading.

Syllabus
ODEs: Euler’s method, asymptotic expansion of the error, Richardson extrapolation, Taylor series method, Runge-Kutta method, multistep methods, leap-frog method, consistency, stability, convergence, root condition, absolute stability, stiff systems, A-stability
PDEs: heat equation, wave equation, finite-difference schemes, artificial viscosity, Crank-Nicolson method, Lax-Wendroff method, operator splitting, ADI, stability analysis, maximum principle, energy method, discrete Fourier analysis, CFL condition, Lax equivalence theorem, Kriess matrix theorem, pseudospectral method, trigonometric interpolation, Gibbs phenomenon, hyperbolic conservation laws

Course Grade
homework = 30%, midterm exam = 30%, final exam = 40%

The homework will include programming exercises for which you may use any language or system, e.g. Matlab, Python.

Exams
midterm, Thursday, February 28, in class
final, Thursday, May 2, 10:30am - 12:30pm, room tba