

Math 615 Numerical Analysis of Differential Equations

Spring 2023, UAF

instructor: Ed Bueler

elbueler@alaska.edu

CRN: 34643 (in-person)

36848 (sync zoom)

course website: bueler.github.io/nade/

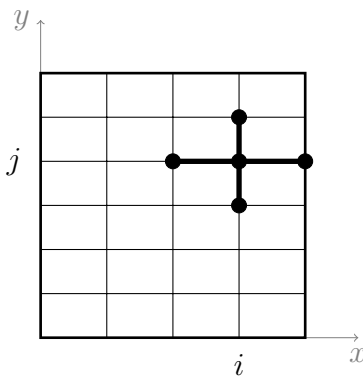
room & time: Brooks 302

MWF 10:30–11:30 am

textbook: R. J. LeVeque, *Finite Difference Methods for Ordinary and Partial Differential Equations*, SIAM Press 2007
(ISBN-13: 978-0-898716-29-0)

practical prerequisites: Linear algebra, some analysis or differential equations, some computer programming, and graduate standing or permission of instructor.

(officially: CS 201, Math 314, Math 426, Math 432)



Numerical approximations of partial differential equations (PDEs) and ordinary differential equations (ODEs) generate simulations of fluid flow, electromagnetic fields, thermodynamics, elastic deformation, quantum mechanics, chemistry, and finance. This course emphasizes finite difference methods for PDEs, with mathematical understanding of stability and convergence, but it also covers ODE numerical schemes.

Every homework includes numerical experimentation using Matlab, Python, Julia, or your preferred language. There is a student-chosen project and two in-class exams.

At the end of the course you will be able to evaluate and use numerical tools for solving many scientific and engineering problems based on differential equations. You will have a mathematical start on the finite element method and spectral methods.

While the course is delivered hybrid, in-person attendance is recommended!

Topics:

- thinking with matrices and vectors
- routine visualization
- finite differences
- stability and convergence
- explicit versus implicit
- adaptive time-stepping
- stiffness
- diffusion and transport
- method of lines
- using iterative linear algebra
- Newton's method

