

Mathematics 5310: Computational Methods in Applied Sciences I
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Syllabus, Spring 2010

Online syllabus: Throughout the entire semester, this syllabus will be online at the URL

<http://www.mgnet.org/~douglas/Classes/na-sc/2010s-notes/syllabus.pdf>

Course Description: First semester of a three-semester computational methods series. Review of basics (round off errors and matrix algebra review), finite differences and Taylor expansions, solution of linear systems of equations (Gaussian elimination variations (tridiagonal, general, and sparse matrices), iterative methods (relaxation and conjugate gradient methods), and overdetermined systems (least squares)), nonlinear equations (root finding of functions), interpolation and approximation (polynomial, Lagrange, Hermite, piecewise polynomial, Chebyshev, tensor product methods, and least squares fit), numerical integration (traditional quadrature rules and automatic quadrature rules), and one other topic (simple optimization methods, Monte-Carlo, etc.).

Prerequisites: Math 3310 and COSC 1010. (3 hours).

Classrooms: Ross Hall 247 (TR, 1:20-2:35)

Class web page: <http://www.mgnet.org/~douglas/Classes/na-sc/2010s-index.html>

Office hours: Tuesday 9:00 – 10:00, Wednesday 2:00 – 3:00, and Thursday 2:30 – 3:30. Please call me first at 766-6580 before coming to Ross Hall 227.

Textbook: George Em Karniadakis and Robert M. Kirby II, *Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and Their Implementation*, Cambridge University Press, 2003 (with a cdrom of software).

Suggested Readings (for a sound theoretical background in numerical analysis), *choose one:*

- Eugene Issacson and Herbert Keller, *Analysis of Numerical Methods*, Dover Publications, 1994.
- John H. Mathews, *Numerical Methods for Mathematics, Science and Engineering*, Prentice-Hall, Englewood Cliffs, NJ (USA), 1992.

Homework: There will be homework from the textbook and programming assignments (usually involving parallel computing) related to the material. Each assignment is due at latest when stated on the class homework web page, which you are responsible for checking on Tuesdays and Thursdays at a minimum. Late work will be accepted by prior arrangement unless there are exceptional circumstances.

Exams: There will be two midterms and a final exam.

Grading: each midterm 15%, final exam 30%, homework 40%.

Learning objectives: Both theoretical and practical uses of scientific computing and numerical analysis should be learned equally throughout the course. Students should know the limits and uses of the algorithms taught in the course. Students should know which ones are useful computationally given a problem to solve for which multiple algorithms taught in this course are applicable.

Cheating Policy: Getting caught cheating or plagiarizing will result in a failing grade and possibly much worse, including expulsion from the university and legal proceedings against you. Check with the university handbook, <http://uwadmnweb.uwyo.edu/REGISTRAR/bulletin/honor.html>, for more details.

Disability Policy: It is University of Wyoming policy to accommodate students, faculty, staff, and visitors with disabilities. If you have a physical, learning, sensory, or psychological disability and require accommodations, please let me know as soon as possible. You will need to register with University Disability Support Services (UDSS) in the Student Educational Opportunity offices, Room 330 Knight Hall, and provide UDSS with documentation of your disability. See the university handbook for more details.