

MATH 2602 Advanced Scientific Computing II

Course #32868, Spring 2008 (2084)

Instructor: Ivan Yotov, Thackeray 303, 624-8374,
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Office hours: MWF 3:00-4:00 and by appointment.

Lecture: MWF 1:00–1:50, Thackeray 627.

Class web page:

www.math.pitt.edu/~yotov/teaching/08-2/math2602.html

Prerequisites: Introductory material on advanced calculus, linear algebra, and differential equations

Content: The course will cover several topics in discretizations of partial differential equations and the solution of the resulting algebraic systems. Topics in discretizations will include mixed finite element methods, finite volume methods, mimetic finite difference methods, and local discontinuous Galerkin methods. Topics in solvers will include domain decomposition methods and multigrid methods. Applications to flow and transport in porous media, as well as coupled fluid and porous media flows will be discussed. The computational exercises will involve running codes on the departmental shared and distributed memory parallel computers.

Homework: Written homework and computational projects will be assigned. A programming language of choice can be used. Help will only be provided for Matlab and Fortran. The finite element package Freefem++ <http://www.freefem.org> will be used for some of the computer assignments.

Grading Policy: The course grade will be based on the homework and the computational assignments.

References:

- J. Bear, Dynamics of fluids in porous media, Dover, 1972.
- J. H. Bramble, Multigrid methods, Longman Scientific and Technical, 1993.
- F. Brezzi and M. Fortin, Mixed and hybrid finite element methods, Springer-Verlag, 1991.
- W. L. Briggs, V. E. Henson, and S. F. McCormick, Multigrid tutorial, 2nd ed., SIAM, 2000.
- B. Smith, P. Bjorstad, and E. Gropp, Domain decomposition: parallel multilevel methods for elliptic partial differential equations, Cambridge University Press, 1996.
- A. Quarteroni and A. Valli, Numerical approximation of partial differential equations, Springer, 1997.
- A. Quarteroni and A. Valli, Domain decomposition methods for partial differential equations, Oxford Science Publications, 1999.
- Various papers.