Scientific Computing, I
Math 224 - Fall 2007

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Course Synopsis

Prerequisites

Mathematics 103 (multivariable calculus) and Mathematics 104 (linear algebra) or equivalents are needed for the mathematical background. Basic experience in programming in C/C++ or FORTRAN or MATLAB is also necessary (at the level of CPS 006 or higher).

Synopsis of course content

An introduction to programming for scientific applications. Math 224 focuses on efficient computational approaches to solve problems from linear algebra and nonlinear systems. Topics include solution of linear systems through direct and iterative methods, matrix factorizations and approximations, least square problems, eigenproblems, nonlinear equations and optimization, interpolation, numerical integration and differentiation, initial value problems for ODEs. Mathematical background is used to develop stable, reliable, accurate, and efficient numerical algorithms to be implemented in scientific programming language.

Textbooks

- *Scientific Computing, An Introductory Survey*, 2nd edition, by Michael T. Heath

- *Scientific Computing* by John Trangenstein (lecture notes available on the web)

Other references:

- *Numerical linear algebra*, L.N. Trefethen and D. Bau

- *Matrix computations*, G.H. Golub and C.F. Van Loan

- *Numerical recipes in C*, 2nd edition, by Press et al.

- *Numerical mathematics*, Quarteroni, Sacco, and Saleri

Assignments

Weekly problem sets will include theory, analysis and computational projects. A written solution and hardcopy of every code, input or output must be submitted for each problem. An electronic copy of our code must also be submitted to me via e-mail, in a unique zip or tar/gzip file. Requests for extensions on homework should be done before the due data; unexcused late assignments will be penalized. You are encouraged to discuss the homework problems with your classmates, but your final submission must be entirely your own independent work (see the Duke Community Standard).

Exams

Two exams. Grade to be based on weekly assignments and exams.

Recommended Programming language: C/C++, Matlab; symbolic algebra: Maple; document preparation: LaTeX

Additional Information

Students from all areas of science, engineering, economics and quantitative studies that need advanced level skills in solving larger scale problems are encouraged to enroll. Math 225: Scientific Computing II (Spring) continues this material and focuses on problems for integrals and differential equations.