Numerical Analysis / Scientific Computing
CS 51400 / Math 514, 3 Credits, Spring 2020
Tues, Thurs 10:30 - 11:45 AM, Haas G066

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This course is intended to be a first graduate course in Numerical Algorithms for graduate students in computer science, mathematics, statistics, computational science and engineering, engineering, and related fields. This is suitable as a foundational course for students from all these fields who use numerical algorithms in their work.

The course will provide an introduction to the basic techniques and algorithms in what is now called Scientific Computing. We will cover the topics traditionally included in such a course at the graduate level, with the exception of topics in numerical linear algebra (matrix computations), discussed in CS 515, and numerical optimization, discussed in CS 520. An undergraduate version of this course is available as CS314, and for students from disciplines other than CS and Mathematics, this might be more suitable depending on your previous knowledge of this material. Pre-requisites for this course would be knowledge of numerical algorithms (e.g., solution of linear and nonlinear equations, polynomial interpolation, least-squares data fitting) at the undergraduate level. You should be comfortable programming in Matlab, C, C++, or Python.

The topics discussed will include:

- Floating point arithmetic, the IEEE floating point standard
- Condition of problems, stability of algorithms
- Solution of nonlinear equations
- Algorithmic differentiation
- Polynomial interpolation
- Piecewise polynomial interpolation, splines
- Approximation of functions
- Numerical integration
- Numerical solution of ordinary differential equations

Students will be graded on regular homework problems, programming assignments, quizzes, and three in-class exams: two midterm exams and a final exam. Programming assignments could be completed using Matlab or Python.

The text book we will be using is

Uri Ascher and Chen Greif, *A First Course in Numerical Methods*, Society for Industrial and Applied Mathematics, 2011. (ISBN 978-0-898719-97-0) **Required.**

Students unfamiliar with Matlab might find an introductory book helpful:

Tobin Driscoll, *Learning Matlab*, SIAM, 2009.