Math 297s: Numerical methods for differential equations

http://www.math.psu.edu/brannick/297s.html

Instructors:

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Time and Place:
Spring Semester at PSU: Tues 6-8 Thomas 209.
Summer Program at PKU: two hour lectures in the morning, 9:00-11:15 AM; office hours in the afternoon.

Textbook:
**Homework and Exams:**
There will be several homework assignments including computer group projects, in which students work as a team to analyze and implement algorithms for solving differential equations. The final exam will be given at the end of the summer program. The final grade is based on the homework (70%) and a final exam (30%).

**Main topics for the Spring Semester:** (13 lectures)

1. Solution of linear system
   1.1.1. LU decomposition and Cholesky decomposition.
   1.1.2. Gaussian elimination
   1.1.3. Iterative methods (2 lectures)

2. Numerical solution of ordinary differential equations
   2.1.1. Finite difference approximation of derivatives
   2.1.2. An explicit method
   2.1.3. Convergence and stability
   2.1.4. Implicit methods

3. Elliptic equations in 1D: Two point boundary value problems
   3.1. General solutions and the Green's function (2.1.1, 2.1.2)
   3.2. Smoothness and the maximum principle (2.1.3, 6.1)
   3.3. A finite difference approximation (2.2.1, 2.2.2)
   3.4. Gaussian elimination of a tri-diagonal system (2.2.3)
   3.5. The finite difference equation (2.3.1)
   3.6. Convergence analysis by computation*