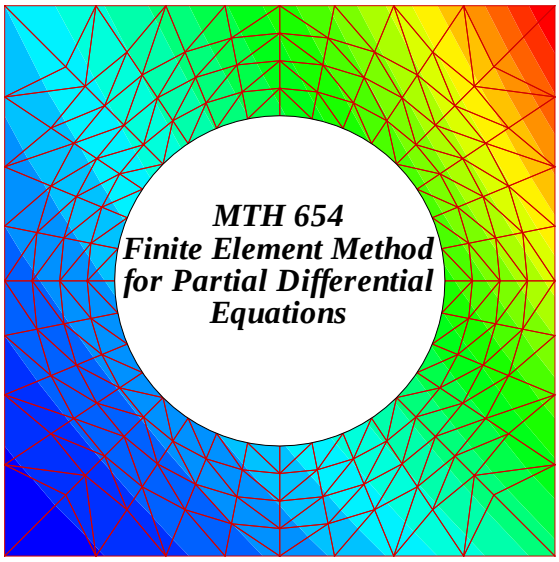
MTH 654/Numerical Analysis, Fall 2011
Finite Element Methods for Partial Differential Equations



http://www.math.oregonstate.edu/∼mpesz/654_F11
Instructor: Małgorzata Peszyńska, Department of Mathematics,
mpesz@math.oregonstate.edu
Class: MWF 9:00-9:50, STAG 107, CRN: 14467 (MTH 654)/ 14469 (MTH 659)

Background: The Finite Element Method (FEM) is a numerical method for solving partial differential equations. It is widely used in various scientific and engineering applications.

The strengths of FEM are multi-fold. First, its mathematical basis, with roots in variational calculus in Hilbert spaces, allow for elegant analysis of delicate problems which may not have classical solutions. Second, on the applications side, FE offer great flexibility for approximation of solutions to problems on irregular domains, with highly varying coefficients, and with singularities. The implementation aspects for FE are very well understood and developed and the FEM remains an active field of research with a vibrant mathematical and applications community.

Content: In the course we will develop the mathematical foundations and algorithmic aspects of FEM. Topics will include error estimates, stability analysis, grid adaptivity, and implementation issues. We will focus on linear stationary problems but, time permitting, nonlinear and nonstationary problems will be also discussed. The necessary mathematical background in functional analysis, numerical integration, interpolation and approximation theory will be developed. The assignments will be a mixture of theoretical and computational exercises. For implementation, templates will be provided both in MATLAB and via public-domain libraries, and a computer lab will be held to help students develop their projects.

Students: The course is intended for graduate students of mathematics and various science and engineering disciplines but motivated undergraduates are also welcome. The basics of real variables and differential equations are required. Familiarity with numerical methods, partial differential equations, and with computer programming are a plus but are not required. [Please contact the instructor if you have any questions].

MTH 654-656 Sequence: This course is the first in a year-long sequence, and the courses in this sequence can be taken independently. This particular topic was taught in [S04, W06, W08, W10].