



Finite Element Analysis

UBC Math 521 Spring 2015

Syllabus

Welcome to UBC's spring 2015 offering of Math 521, Finite Element Analysis.

The finite element method is commonly used to solve PDEs on irregularly-shaped domains. In addition, a complete study of this numerical method deepens our understanding of the mathematics of function spaces and optimization, as well as the computational practicalities of object-oriented programming and visualization.

- Instructor: Roger Donaldson rdonald@math.ubc.ca
- Office: Math 238
- Class: Tuesdays and Thursdays, 9:30am-11:00am, Barber Centre Rm 157
- Office hours: by appointment
- Website: <http://11-rdonald.math.ubc.ca/math521>

Prerequisites

- Mathematics: linear algebra, multivariable calculus, PDEs
- Computing: numerical analysis, proficiency in a computing language (Python, C++, Fortran, Matlab)

In addition, students will benefit from having some real analysis background and may wish to take Functional Analysis (Math 421/510) concurrently.

Topics

The first part of the course will cover topic core to finite element analysis:

- Elliptic problems
- Function spaces
- Error estimates
- Solution methods
- Parabolic problems

In addition, special topics will be chosen from the following:

- Boundary element methods
- Discrete differential forms
- Mesh generation
- Mixed finite element methods
- Hyperbolic problems
- Non-linear problems

Coursework

The course deliverables consist of assignments and a project.

- Assignments: 50% These will be somewhat difficult and much of the work will require that you write computer programs.
- Project: 50% The project will be of a topic of your choosing, and should consist of a report based on some numerical computation.

References

Course material will be provided through class lectures and through your own reading prompted by those lectures. Wherever possible, course topics, particularly the special topics, will be supplemented by publications posted on the course website.

There is no assigned textbook for this course, though you may find it helpful to have a finite element text on hand for general reference.