ISC 5939 - Advanced Graduate Seminar

Finite Elements and Numerical Modeling

Spring 2015

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Website:	http://www.sc.fsu.edu/∼jburkardt/classes/sem_2015/sem_2015.html
Time and Room:	?:?:00-?:50, 499 DSL
Text:	No textbook; Students will refer to research papers in journals.

Course Description: This seminar course is designed to encourage students to explore, write up, present and discuss a number of topics associated with the finite element method, computational partial differential equations, and numerical modeling.

The class will begin with several overview lectures, intended to ensure that all students have a common working background. These lectures will present a model PDE, the weak and discretized weak formulations, the role of meshing, basis functions, quadrature, and linear solvers.

After the introductory classes are complete, each week, one student will volunteer to read a research paper or investigate a topic, and then give a 15 minute presentation in class. Thereafter, for 15 minutes, the instructors will pose questions, and the audience will discuss the topic further. Finally the instructor will present one in a series of 15 minute talks on aspects of the FreeFem++ program. (It is hoped that some of the seminar participants will choose to use FreeFem++ when preparing their presentations.)

A list of suggested research papers will be offered by the instructors, but a student is free, with the instructor's approval, to choose any appropriate research paper, or to select a general topic, such as:

- What are bubble elements, and how are they used?
- The H-P method - error reduction by shrinking size (h) or increasing element order (p);
- How can finite elements be applied to a Stokes or Navier-Stokes problem?
- Isoparametric elements for better approximation of curved boundaries.
- least squares finite element methods;
- macro elements;
- The penalty method for approximately enforcing constraints;
- assembling, factoring, solving the typical FEM linear system;
- strategies for parallel execution;
- SUPG stabilization;

- comparison of open-source finite element packages (DEAL.II, FENICS, FREEFEM++, IFISS, Matlab PDE Toolbox);
- the discontinuous Galerkin method.

Each student is expected to present at least one paper or topic, to attend every class, and to participate in the discussions.

Course Objectives: Students completing the course will be able to:

- read, understand, present, and answer questions on a specific paper in the field;
- list the characteristics of current areas of research that use finite elements and numerical modeling;
- solve a finite element problem by creating input files for FreeFem++ (or Deal.II or FENICS or other preferred software).

Grading: The student's grade for the course will be based upon:

- Presentation - 50%
- Participation - 25%
- Attendance - 25%

University Attendance Policy: Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy: The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of student's academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to . . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University. (Florida State University Academic Honor Policy, found at http://academichonor.fsu.edu/policy/policy.html.)

Americans with Disabilities Act Students with disabilities needing academic accommodation should:

- register with and provide documentation to the Student Disability Resource Center; and
- bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the Student Disability Resource Center, sdrc@admin.fsu.edu, web page: http://www.disabilitycenter.fsu.edu/.

Syllabus Change Policy Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.