CIVIL EN/MATH 5168
Introduction to the Finite Element Method

Instructor: Ching-Shan Chou
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Class schedule: MWF 11:30 am -12:25 pm at Caldwell Lab 137

Office hours: MW 3:55 - 5:00 pm

Prerequisites:
Civil En 2060 (406), Math 2568 (568), and CSE 1221, or equivalent, or grad standing in Engineering or Math. Not open to students with credits for both CivilEn 768 and MechEng 7068. Cross-listed in CivilEn. Basic knowledge of programming in MATLAB will be required.

Textbook:
There is no required textbook for the course. Recommended supplemental materials are:
1. Computational Differential Equations, Volume 1, by K. Eriksson, D. Estep, P. Hansbo and C. Johnson. Cambridge University Press (1996).
2. *Finite Elements: An introduction, Volume I*, by Eric B. Becker, Graham E. Carey and J. Tinsley Oden, Prentice Hall (1981).
3. *An Analysis of the Finite Element Method,* by William Gilbert Strang and George J. Fix, Wellesley-Cambridge Press (1973).

Website:
Class materials and announcements will be posted on https://carmen.osu.edu.

Course Objectives:
To introduce the basic concepts, formulation and application of finite element methods to solve problems of engineering and scientific interest. The course is designed to a concise introduction emphasizing the salient features of the method with enough details presented to provide a solid foundation for more advanced courses and/or research in the area of finite element methods.

Homework:
Homework problems will (generally) be assigned on a bi-weekly basis. These problems, along with material covered in lecture, will form the basis for exam problems.

Project:
The course project will mainly consist of implementing the finite element method in a working code. Students may work independently or in groups of two; however, each student is expected to develop and maintain their ***own*** finite element code. Each group will choose one or several topics that will expand their code beyond the basic implementation of the finite element method. The list of possible topics will be distributed mid-semester.

Exams:
There will be two, closed-book examinations – a midterm and a final. The finial exam will be comprehensive with an emphasis on the material covered after the midterm. No students will be permitted to make up an exam unless ***advanced*** notice of absence is given to the instructor ***in person***.

Final Grade:
1. Homework: 15%
2. Project: 25%
3. Midterm exam: 30%
4. Final exam: 30%

E-mail Correspondence:
In order to protect your privacy, all course e-mail correspondence must be done through a valid OSU name.nn account. If you have not activated your OSU email account, you can activate your account at https://my.osu.edu/public/IdentityManagement/

***Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities. http://www.ods.ohio-state.edu**

***It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term ``academic misconduct'' includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee. For additional information, see the Code of Student Conduct http://studentaffairs.osu.edu/resource_csc.asp.**

Tentative Class Schedule (exam dates are colored by yellow):

Monday	Wednesday	Friday
1/11 Introduction to formulation and the basic problems	1/13 Introduction to formulation and the basic problems	1/15 Introduction to formulation and the basic problems
1/18 MLK – no class	1/20 Strong and weak forms and the Galerkin method	1/22 Strong and weak forms and the Galerkin method
1/25 The finite element method in one dimension	1/27 The finite element method in one dimension	1/29 The finite element method in one dimension
2/1 Finite element calculations in one dimension	2/3 Finite element calculations in one dimension	2/5 Finite element calculations in one dimension
2/8 Development of a one-dimensional finite element code I	2/10 Development of a one-dimensional finite element code I	2/12 Development of a one-dimensional finite element code I
2/15 Development of a one-dimensional finite element code II	2/17 Development of a one-dimensional finite element code II	2/19 Development of a one-dimensional finite element code II
2/22 Interpretation and accuracy of finite element solutions	2/24 Interpretation and accuracy of finite element solutions	2/26 Interpretation and accuracy of finite element solutions
2/29 Introduction to two-dimensional problems	3/2 Introduction to two-dimensional problems	3/4 Midterm
3/7 The finite element method in two dimensions	3/9 The finite element method in two dimensions	3/11 The finite element method in two dimensions
3/14 Spring break	3/16 Spring break	3/18 Spring break
3/21 Finite element calculations in two dimensions	3/23 Finite element calculations in two dimensions	3/25 Finite element calculations in two dimensions
3/28 Development of a two-dimensional finite element code I	3/30 Development of a two-dimensional finite element code I	4/1 Development of a two-dimensional finite element code I

continued		
4/4 Development of a two-dimensional finite element code II	4/6 Development of a two-dimensional finite element code II	4/8 Development of a two-dimensional finite element code II
4/11 Advection-dominated and time-dependent problems	4/13 Advection-dominated and time-dependent problems	4/15 Advection-dominated and time-dependent problems
4/18 Discontinuous Galerkin finite element methods	4/20 Course summary	4/22 Review for final exam
4/25 Final exam	4/27	4/29