Spring 2021 Graduate Course Announcement

MATH 5563: Finite Element Methods for Partial Differential Equations
(TR 9am-10:15am, MSCS 115)

Instructor: Dr. Xu Zhang

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Scope of course: Finite element methods (FEM) for both steady-state and time-dependent partial differential equations.

Goal of course: Even though fundamental topics in finite element method will be covered by this course, the main goal is not to cover as many advanced topics as possible, but a thorough understanding of the finite element methods in both computation and theory, the capability to independently implement FEM to obtain a unified computational package for all types of partial differential equations, the capability to understand and modify existing finite element packages, and the capability to efficiently self-study other FEMs which cannot be covered by this one-semester course.

Style of course: For each type of partial differential equations covered in this course, we will introduce the corresponding finite element methods step by step in a unified framework, which will eventually provide a unified finite element package for all types of partial differential equations. Starting from the mesh generation and the construction of the finite element basis functions, we will derive the weak formulation, discretization formulation, and matrix formulation, discuss the advantages/disadvantages and the implementation issues, have guided coding practice, and carry out the numerical analysis in class. In order to illustrate how to apply the FEM in practice, applications of these methods will be also discussed, including those in my research. After class, the homework and the take-home exams, which are in project format, will provide you opportunities to apply the methods and analysis you learn in class and the code you obtain through the guided coding. The independent study will provide you experience in self-studying other FEM and the existing packages by using the technique introduced in this course. At the end of the semester, the students are expected to have a thorough understanding of finite elements and their own finite element packages.

Text: No textbook is needed. We will use our own notes and slides.

Questions? Feel free to contact me!