MA361 Partial Differential Equations

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Lectures: Mondays and Wednesdays, 10:00-11:15 am

Course webpage: http://personal.stevens.edu/~nstrigul/MA361/index_PDE.html

General comments:

MA361 is an undergraduate course in partial differential equations (PDEs). The major goal of this course is to study three types of PDEs—elliptic, hyperbolic, and parabolic—in a single spatial dimension, using both analytical and numerical methods. Specifically, we will carefully study how to deal with boundary value problems (BVPs) for the Laplace, wave, and heat equations. The course will also include necessary chapters of linear algebra and ordinary differential equations, and include an extensive computational part, employing the Mathematica software package. We will emphasize as much as possible the physical and geometrical ideas behind the theory, to keep results intuitively clear. The mandatory material will be the first seven chapters of Mark Gockenbach's book; this is the textbook which all students should buy. However, some lectures will be based on other texts, such as the first volume of R. Courant and D. Hilbert's classic "Methods of Mathematical Physics" and G. Strang's "Introduction to Applied Mathematics". Providing that the mandatory material is covered, we will proceed to consider modeling methods, such as scaling and nondimensionalisation, using the Navier-Stokes equations as an example.

Textbooks:

3) Introduction to Applied Mathematics by G. Strang.
4) Equations of Mathematical Physics by V. S. Vladimirov.
5) Equations of Mathematical Physics by S. G. Mihlin.

Course program:


Jan 22. Lecture 2. - Derivation of the classical models 1.


Feb 12. Lecture 8. - BVPs in statics 1. The analogy between BVPs and linear algebraic systems.


Apr 2. Lecture 20. - Finite element methods for the wave equation.


Apr 9. Lecture 22. - Physical models in two or three spatial dimensions 1. The heat equation.

Apr 11. Lecture 23. - Physical models in two or three spatial dimensions 2. The wave equation.

Apr 16. Lecture 24. - Physical models in two or three spatial dimensions 3. The Laplace's equation.

