Math 8583: Partial Differential Equations
Fall 2014

Syllabus

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Textbook: Lawrence Craig Evans: Partial Differential Equations, 2nd ed., AMS 2010.
Meeting time: 10:10–11:00 in Vincent Hall 301.

This course is appropriate for graduate students using or developing the analysis of PDEs in pure and applied mathematics, as well as in areas of science and engineering which make significant use of PDEs. Minnesota has a strong reputation in PDEs around the world. Our emphasis will be on nonlinear equations.

We will begin with problems involving linear PDEs, including representation of solutions in terms of boundary/initial conditions:
- Laplace's equation.
- The transport equation.
- The heat equation.
- The wave equation.

We will then turn our attention to nonlinear first-order PDEs:
- Characteristic curves.
- Entropy conditions.
- Conservation laws.

We will next briefly visit the separation of variables:
- Fourier transform.
- Radon transform.
- Laplace transform.
- Homogeneization.

before turning to a detailed theory for linear PDEs:
- Sobolev spaces (briefly).
- Sobolev inequalities.
- Traces.
- Almost everywhere differentiability.
- Weak solutions.
- Fixed-point methods.
- Sub- and supersolutions.
- Conservation laws.

Prerequisites are analysis of several variables at the upper-division level; we will not assume students have taken courses on partial differential equations or functional analysis, but will review theorems and techniques from those areas.

Grades for Math 8583 will be based on five problem sets (50%) and the take-home final exam (50%).

Problem set due F 19 September:
pp.12f: #1,4; pp. 85ff: #2, 4, 5, 9, 11, 12, 13 (delete the "Explain" sentence), 16, 17, 19, 21a.