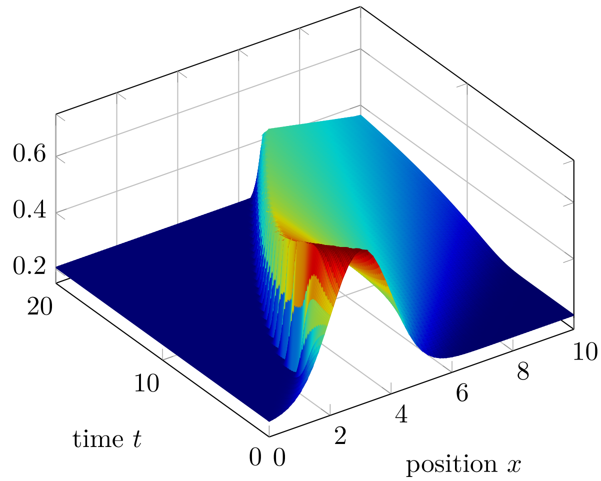
Syllabus: APM 576 - Theory of PDE I
Fall 2017



- Instructor: Sebastien Motsch (email: `smotsch@asu.edu`)
- Class: M,W 10:45-12:00 (LL 264)
- Office hours: M,W 1:00-3:00pm (WXLA 836)
- Class webpage: `www.seb-motsch.com/graduate`

Textbook: L. Evans, *"Partial Differential Equations"* (2nd edition)

Secondary book: H. Brézis, *"Functional Analysis, Sobolev Spaces and Partial Differential Equations"*

Course Description

This course introduces rigorous methods to study partial differential equations such as existence theory and global behavior of solutions. The goal is to understand *intuitively* PDEs and then to develop analytic skills to *prove* results. This class is intended to be spread over two semesters, the first semester will be focused on **linear PDEs** (e.g. elliptic, parabolic equations) and the second semester on **non-linear PDEs** (e.g. conservation laws, Hamilton-Jacobi equations).

Although, there will be no numerical studies of PDEs in this class, numerical solutions will be often used to visualize the behavior of the solutions which helps hindsight. See for instance: `http://seb-motsch.com/geek/pde_solver_flex.html`

The course is divided into four parts:

a) **Review** (*chap. 2.1-2.3*): we will review some examples of PDEs with explicit solutions and study *formally* their behaviors.

b) **Functional analysis** (*chap. 5.2-5.7*): from L^p to Sobolev spaces H^1 (where do solutions of PDEs live?), useful results (approximation by smooth functions, Compactness, Sobolev inequality...)

c) **Elliptic PDEs** (*chap. 6*): solving boundary value problem (i.e. $\Delta u = f$)

d) **Evolution equations** (*chap. 7*): solving hyperbolic/parabolic PDEs: $\partial_t u + c \cdot \nabla_x u = \Delta_x u$. If time allows, a short introduction on semi-group theory will be covered.

Grading

Biweekly homework (6 homework in total) and a presentation.