251A Intro. to PDEs Spring 2024

Time and Place: MWF 10am at MS 6201

We will focus on Energy method. Topics to be discussed include:

- Existence of energy minimizer, Euler-Lagrange Equation.
- Convex Duality
- Constraints
- Elliptic regularity
- BV spaces and geometric variational problems, minimal surfaces.
- Evolution problems: gradient flows. Wasserstein space, minimizing movements.

We will assume that students are familiar with basic measure theory (245AB). We will discuss any other necessary preliminary material as we proceed.

Homework: There will be 4-5 sets of homework problems, assigned every two weeks. To pass the course we require

References will include:

- Evans, *Partial Differential Equations.*
- Santambrogio, *A course in the calculus of variations.*
- Struwe, *Variational Method.*
- Fernandez-Real, Ros-Oton, *Regularity Theory for Elliptic PDE,* https://arxiv.org/abs/2301.01564
- Evans and Gariepy, *Measure theory and Fine properties of Functions.*
- Connor, Lecture note on minimal surfaces.
- Santambrogio, *Gradient flows: an Overview,* Bulletin of Mathematical Sciences 7, 87- 104 (2017).