

INTRODUCTION TO GEOMETRIC MEASURE THEORY

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FALL 2017 - MATH 581

Geometric Measure Theory (GMT) is a classical subject in geometric analysis which in recent years has seen a new revival. Tools introduced to study perimeter minimizers and minimizing surfaces have found applications in areas such as metric geometry, harmonic analysis, free boundary problems and theoretical computer sciences. The goal of this three quarter sequence is to introduce the subject (Math 581), present the theory of perimeter minimizers and *almost* minimizers (Math 582) and then discuss some its recent applications (Math 583).

The aim of the course is to cover most of [EG] while introducing ideas from several of the books referenced below, in particular [M1].

- Advanced Measure Theory
 - Covering Theorems
 - Differentiation of Radon Measures
 - Riesz Representation Theorem
 - Weak Convergence
- Hausdorff Measures
- Area and Coarea Formulas
 - Lipschitz Functions, Rademacher's Theorem
 - Linear Maps and Jacobians
 - The Area Formula
 - The Coarea Formula
- Sobolev Functions
- Functions of Bounded Variation, Sets of Finite Perimeter
 - Definitions, Structure Theorem
 - Approximation and Compactness
 - Coarea Formula for BV Functions
 - Isoperimetric Inequalities

- The Reduced Boundary
- Gauss-Green Theorem
- Pointwise Properties of BV Functions
- Essential Variation on Lines
- Criterion for Finite Perimeter
- Approximation by C^1 Functions
 - Convex Functions
 - Whitney’s Extension Theorem

References:

- [AFP] Functions of Bounded Variation and Free Discontinuity Problems, L. Ambrosio, N.Fusco & D. Pallara.
- [EG] Measure Theory and Fine Properties of Functions, Revised Edition, L. C. Evans & R. F. Gariepy
- [G] Minimal Surfaces and Functions of Bounded Variations, E. Guisti.
- [M1] Sets of Finite Perimeter and Geometric Variational Problems, F. Maggi.
- [M2] Geometry of sets and measures in Euclidean spaces : fractals and rectifiability, P. Mattila.
- [S] Lectures on geometric measure theory, L.M. Simon.

Instructor Information:

Instructor: Tatiana Toro
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Class schedule: Monday - Wednesday 9:00-10:20. Some Fridays 9:00-10:20.

Prerequisites: Real Analysis or instructors approval.