

Math 8230 Topics in Geometry/Topology

Fall 2007

- **Time and Place:** MWF 1:25 -- 2:15, Boyd 326.
 - **Instructor:** Sa'ar Hersonsky
 - **E-mail:** saarh@math.uga.edu No email w/o Javascript.
 - **Office:** Boyd 408 **Office Phone:** 2587
 - **Office Hours:** TBA
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Course Description

This is an introductory course in variational problems in geometry and topology. Many contemporary mathematical problems may be formulated as variational problems in surfaces or higher dimensional manifolds. Basic examples are finding geodesics on surfaces or finding the surface of minimal area spanning a given frame of wire (originally appeared as a mathematical model for soap films).

The theme of this course is to understand critical points of various functionals that are associated with Riemannian manifolds. We will see that these have deep, useful and beautiful properties.

Topics may include:

- Arc length of curves and geodesics
- First and Second variation formulas
- Energy of maps and Harmonic maps

If time permits we will discuss a deep theorem (Eells-Sampson) which asserts the following.

Any smooth map from a compact Riemannian manifold M into a compact Riemannian manifold N of nonpositive curvature is freely homotopic to a harmonic map.

Prerequisites

1. A background of smooth manifolds and/or a basic course on curves and surfaces, as well as an understanding of the fundamental group (this will be most needed in the last part of the course).
2. You are expected to come well prepared for each class: reading carefully previous class notes, filling details in some of the proofs given in class and solving hw problems that I will assign.

Grading

Your grade will be based on your presentation and understanding of a topic (that I will assign you) in our topology/geometry seminar.

Texts

I will follow closely

- Seiki Nishikawa, *Variational Problems in Geometry*, Translations of Mathematical Monographs vol 205 American Mathematical Society, 2002.

However there are many other great books on the subject. Feel free to follow anyone you like.

Note:

1. I would highly recommend that you will come to the geo\top seminar talks and to the colloquium. This is a great opportunity to be exposed to cutting edge research.