

Professor Stefan Papadima

## MTH G375--Topics in Topology: Rational Homotopy Theory

Spring 2006

### ◆ Course Information

**Course:** [MTH G375](#) -- Topics in Topology: Rational Homotopy Theory

**Web site:** <http://www.math.neu.edu/papadima/top06.html>

**Instructor:** Stefan Papadima, Stone Visiting Professor

**Time and Place:** Tue. & Th., 7:30 - 9:00 PM, in 104 KA

**Office Hours:** TBA

**Prerequisites:** MTH G121 [Topology 1](#), MTH G221 [Topology 2](#)

**Textbook:** [Rational Homotopy Theory and Differential Forms](#), by Phillip A. Griffiths and John W. Morgan, Progress in Mathematics, vol 16, Birkhäuser, Boston, MA, 1981

**Supplement:** [Rational Homotopy Theory](#), by Yves Félix, Stephen Halperin, and Jean-Claude Thomas, Graduate Texts in Mathematics, vol 205, Springer-Verlag, New York, 2001

**Grade:** Based on problem sets and class participation

### ◆ Course Description

"The manner in which a closed differential form vanishing in the cohomology of a manifold actually becomes exact contains homotopy information." Informally speaking, Rational Homotopy Theory may be viewed as an elaboration of the above principle. More formally, the theory provides a categorical description of homotopy types of reasonable spaces, modulo torsion, by differential graded algebra models. The course will give an introduction to several basic topics in RHT, such as:

- De Rham algebras and de Rham theorems for simplicial complexes.
- Homotopy theory of fibrations, spectral sequences, and Postnikov decompositions of simply-connected spaces.
- Rationalization of simply-connected spaces.
- Minimal models of topological spaces and continuous maps; algebraic computation of higher rational homotopy groups (in the simply-connected case).
- (Pro)-nilpotent groups and Lie algebras; algebraic computation of the rational completion of the fundamental group of a connected space.

Depending on time and the interests of the audience, further applications of Rational Homotopy Theory may also be sketched: existence of isometry-invariant geodesics on simply-connected

manifolds and/or properties of fundamental groups of connected, smooth, complex algebraic varieties.

The first (organizational) meeting will be held on **Thursday, January 12th**.