MATHEMATICS 667- SPRING 2008- COURSE ANNOUNCEMENT

Introduction to geometric flows

A geometric flow is a partial differential equation that deforms a geometric structure on a manifold- a Riemannian metric or a hypersurface, for example- in the direction of a `preferred subset' of structures (a constant curvature metric, or constant mean curvature surface). Examples are the Yamabe flow, the mean curvature flow and the Ricci flow (also the Einstein equations, in an appropriate gauge). This research got started in the 1980s, connects p.d.e, differential geometry and low-dimensional topology, and has led in recent years to spectacular results (e.g. the proof of the differentiable sphere theorem by Brendle and Schoen, using Ricci flow). A lot remains to be done, and for example there is the hope that understanding how the three flows named above interact may eventually lead to a simplification of Perelman's 3-manifold result.

This introductory course will focus on the early 80s results of Hamilton (Ricci flow) and Huisken (mean curvature), in cases where no singularities develop. The next step is to understand the `soliton solutions' needed for the analysis of singularities via blow-up (1990s). From the recent work, at least Perelman's first gradient functional (for Ricci flow) and the `invariant cones" of Boehm-Wilking (which led to the Brendle-Schoen result) should be accessible (towards the end).

The pre-requisite is a completed (or ongoing) graduate sequence in differential geometry *or* topology *or* p.d.e. Specialized concepts will be introduced as needed, but a certain degree of familiarity with standard terminology will be taken for granted. The main references will be the original papers. *Grading* will be based on writing/delivering a short exposition on a topic not explained in enough detail in the existing literature.

Please send me e-mail if you are interested in the course (preferably by Oct. 1). A minimum enrollment of six students is required for it to run.

Alex Freire