Geometry Seminar
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Room 613, Courant Institute
251 Mercer Street, New York

Greedy Optimal Homotopy and Homology Generators

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Abstract

Many geometric problems, such as texture mapping, remeshing, and morphing, call for a topologically complex surface to be cut into one or more topological disks. Any orientable surface of genus g can be cut into a single topological disk by removing a so-called system of loops: a set of $2g$ cycles sharing a common basepoint. I will describe a simple greedy method, based on Dijkstra's shortest-path algorithm, to compute the shortest system of loops with a given basepoint in $O(n \log n)$ time. This solves an open problem of Colin de Verdière and Lazarus. In fact, our algorithm computes the shortest set of loops that generate the fundamental group of the surface. It is also possible to cut a surface into a single disk with a more general graph, but finding such a cut graph with minimum total length is NP-hard.

This is joint work with Kim Whittlesey, published at SODA 2005.

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