Geometry Seminar
February 13, 2007, Tuesday, 6:00 p.m.
Room 613, Courant Institute
251 Mercer Street, New York

On translational motion planning in 3-space

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Abstract

Constructing the union of geometric objects and bounding its combinatorial complexity is a fundamental problem in computational and combinatorial geometry. A major application of this problem is to translational motion planning, where a polyhedral robot R translates in a fixed polyhedral environment, and one wishes to compute all placements of R (known as free placements) at which it avoids collision with any obstacle.

In this talk, I will give a brief overview of the area, and explain its importance. I will then discuss the union problem, where the input consists of n "fat" tetrahedra in 3-space of arbitrary sizes, and show that in this case the combinatorial complexity of the union $O(n^{5/2+\epsilon})$, for any $\epsilon > 0$, thus obtaining the first subcubic upper bound. An immediate consequence of this result implies that the combinatorial complexity of the union of n cubes in 3-space of arbitrary side lengths, is $O(n^{5/2+\epsilon})$, for any $\epsilon > 0$. In addition, I will show that when the tetrahedra have nearly equal size, this bound becomes $O(n^{2+\epsilon})$, for any $\epsilon > 0$, which is almost tight in the worst case.

The talk will be self-contained. Joint work with Micha Sharir.

For further information contact {pach,pollack}cims.nyu.edu, or visit our website: http://www.math.nyu.edu/seminars/geometry_seminar.html