2010/2011 Seminar Series

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Faculty of Computer Science UNB

Orbitwise Polyhedral Representation Conversion

By:
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Convex polyhedra, the feasible sets of systems of linear inequalities, are used as modelling tools in fields as disparate as operations research, spherical codes and software engineering. One of the basic properties of convex polyhedra is that they can be represented both by a set of inequalities and by a finite set of "extremal" solutions (the so-called "finite-generator" representations).

Converting between the inequality and finite-generator representations of a convex polyhedron is both a fundamental problem in algorithmic geometry and a useful subroutine in various optimization techniques. Unfortunately many problems of interest remain out of reach for current conversion methods. In certain applications the output is both large and symmetric. This has motivated study of the problem of orbitwise representation conversion: instead of producing all of the output, one looks for at least one element in each orbit (under some natural symmetry group).

In this talk I will survey algorithmic ideas for this problem, starting with techniques for decomposing into symmetric subproblems. Time permitting, I will discuss the "symmetrization" of some of the standard methods for representation tranformation based on incremental construction, pivoting, and face lattice generation. Finally I will mention some techniques based on representing the output symmetry geometrically using the notion of a fundamental domain. The last part represents ongoing work with students at UNB.

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