Semidefinite Programming and Approximation Algorithms: A Survey

Sanjeev Arora

Computer Science Dept.
& Center for Computational Intractability,
Princeton University
arora@cs.princeton.edu

Computing approximately optimal solutions is an attractive way to cope with NP-hard optimization problems. In the past decade or so, *semidefinite programming* or SDP (a form of convex optimization that generalizes linear programming) has emerged as a powerful tool for designing such algorithms, and the last few years have seen a profusion of results (worst-case algorithms, average case algorithms, impossibility results, etc).

This talk will be a survey of this area and these recent results. We will survey three generations of SDP-based algorithms. Each generation involves new modes of analysis, which have also led to new results in mathematics. At the end we will touch upon work that draws upon the so-called *Matrix Multiplicative weight method*, which greatly improves the running time of SDP-based algorithms, making them potentially quite practical. These algorithms have also found surprising application in Quantum computing, especially the recent result QIP=PSPACE.

The survey will be essentially self-contained.