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*Conic Optimization: Relaxing at the Cutting Edge*

The relationship between nonlinear conic optimization and discrete optimization has been the subject of intense research since the advent in the mid-1990s of the maximum-cut approximation algorithm of Goemans and Williamson that hinges on the use of a semidefinite relaxation. Semidefinite relaxations, and other nonlinear conic relaxations, have since been constructed for various discrete optimization problems. This research has led to important theoretical and computational advances. In this presentation we survey these advances, primarily from a computational standpoint, for graph partitioning problems and for ordering problems. For several versions of these problems, the use of conic relaxations within an enumeration scheme is the basis of the state-of-the-art algorithms. The effectiveness of these algorithms critically depends on the judicious use of cuts to improve the bounds. We present the cutting edge in linear and nonlinear techniques to iteratively tighten the conic relaxations.