Towards Higher Order Semidefinite Relaxations for Cut Problems

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Abstract: The basic semidefinite relaxation for Max-Cut, underlying the Goemans-Williamson hyperplane rounding procedure, allows various tightenings. The simplest one includes constraints from the metric polytope. More refined approaches are iterative, and provide a sequence of relaxations, which come arbitrarily close to the convex hull of cut vectors, but at an increasingly high computational effort. A natural systematic hierarchy was introduced by Lasserre. The first step in this hierarchy corresponds to the basic semidefinite relaxation, the second one is a relaxation in the space of matrices of order n^2.

We propose an iterative refinement of the semidefinite relaxation intersected with the metric polytope, which can be viewed either as an approximation towards the first nontrivial relaxation in the Lasserre hierarchy, or as a refinement using semidefinite cuts.

Some preliminary theoretical results as well as first computational experience is reported.

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