ABSTRACT

We define the multilinear polytope as the convex hull of a set of binary points satisfying a collection of multilinear equations. This set corresponds to the convex hull of the feasible region of a linearized binary polynomial optimization problem. By introducing a hypergraph representation framework, we relate the complexity of the facial structure of the multilinear polytope to the acyclicity degree of the corresponding hypergraph. We then demonstrate how different degrees of acyclicity can be used to obtain compact formulations for the multilinear polytope in the original or in an extended space. This in turn enables us to identify several classes of polynomial-time solvable binary polynomial optimization problems and to construct strong linear programming relaxations for general mixed-integer polynomial optimization problems. This is joint work with Alberto Del Pia.

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