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Algorithmic and Complexity Results for Cutting Planes Derived from Maximal Lattice-Free Convex Sets

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We study a mixed integer linear program with m integer variables and k non-negative continuous variables in the form of the relaxation of the corner polyhedron that was introduced by Andersen, Louveaux, Weismantel and Wolsey [Inequalities from two rows of a simplex tableau, Proc. IPCO 2007, LNCS, vol. 4513, Springer, pp. 1--15]. We describe the facets of this mixed integer linear program via the extreme points of a well-defined polyhedron. We then utilize this description to give polynomial time algorithms to derive valid inequalities with optimal l_p norm for arbitrary, but fixed m. For the case of m=2, we give a refinement and a new proof of a characterization of the facets by Cornuejols and Margot [On the facets of mixed integer programs with two integer variables and two constraints, Math. Programming 120 (2009), 429--456]. The key point of our approach is that the conditions are much more explicit and can be tested in a more direct manner, removing the need for a reduction algorithm. These results allow us to show that the relaxed corner polyhedron has only polynomially many facets.

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