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Convexification techniques for linear complementarity constraints. (English) Zbl 1341.90130
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Summary: We develop convexification techniques for linear programs with linear complementarity constraints (LPCC). In particular, we generalize the reformulation-linearization technique of [*H. D. Sherali* and *W. P. Adams*, SIAM J. Discrete Math. 3, No. 3, 411–430 (1990; [Zbl 0712.90050](#))] to complementarity problems and discuss how it reduces to the standard technique for binary mixed-integer programs. Then, we consider a class of complementarity problems that appear in KKT systems and show that its convex hull is that of a binary mixed-integer program. For this class of problems, we study further the case where a single complementarity constraint is imposed and show that all nontrivial facet-defining inequalities can be obtained through a simple cancel-and-relax procedure. We use this result to identify special cases where McCormick inequalities suffice to describe the convex hull and other cases where these inequalities are not sufficient.

For the entire collection see [[Zbl 1216.90002](#)].

MSC:

- [90C33](#) Complementarity and equilibrium problems and variational inequalities (finite dimensions) (aspects of mathematical programming) Cited in 9 Documents
- [90C05](#) Linear programming
- [90C11](#) Mixed integer programming
- [90C57](#) Polyhedral combinatorics, branch-and-bound, branch-and-cut

Full Text: [DOI](#)

References:

- [1] Balas, E.: Disjunctive programming: Properties of the convex hull of feasible points. Discrete Applied Mathematics ~89(1-3), 3–44 (1998); original manuscript was published as a technical report in 1974 · [Zbl 0921.90118](#) · [doi:10.1016/S0166-218X\(98\)00136-X](#)
- [2] Balas, E., Ceria, S., Cornuéjols, G.: A lift-and-project cutting plane algorithm for mixed 0–1 programs. Mathematical Programming ~58, 295–324 (1993) · [Zbl 0796.90041](#) · [doi:10.1007/BF01581273](#)
- [3] de Farias, I.R., Johnson, E.L., Nemhauser, G.L.: Facets of the complementarity knapsack polytope. Mathematics of Operations Research ~27, 210–226 (2002) · [Zbl 1082.90586](#) · [doi:10.1287/moor.27.1.210.335](#)
- [4] Ferris, M.C., Pang, J.S.: Engineering and economic applications of complementarity problems. SIAM Review ~39, 669–713 (1997) · [Zbl 0891.90158](#) · [doi:10.1137/S0036144595285963](#)
- [5] Hu, J., Mitchell, J.E., Pang, J.S., Yu, B.: On linear programs with linear complementarity constraints. Journal of Global Optimization (to appear) · [Zbl 1254.90111](#) · [doi:10.1007/s10898-010-9644-3](#)
- [6] Jeroslow, R.G.: Cutting-planes for complementarity constraints. SIAM Journal on Control and Optimization ~16(1), 56–62 (1978) · [Zbl 0395.90076](#) · [doi:10.1137/0316005](#)
- [7] Rockafellar, R.T.: Convex analysis. Princeton University Press, Princeton (1970) · [Zbl 0193.18401](#) · [doi:10.1515/9781400873173](#)
- [8] Rockafellar, R.T., Wets, R.J.B.: Variational analysis. A Series of Comprehensive Studies in Mathematics. Springer, Berlin (1998) · [Zbl 0888.49001](#) · [doi:10.1007/978-3-642-02431-3](#)
- [9] Sherali, H.D., Adams, W.P.: A hierarchy of relaxations between the continuous and convex hull representations for zero-one programming problems. SIAM Journal on Discrete Mathematics ~3, 411–430 (1990) · [Zbl 0712.90050](#) · [doi:10.1137/0403036](#)
- [10] Sherali, H.D., Krishnamurthy, R.S., Al-Khayyal, F.A.: Enumeration approach for linear complementarity problems based on a reformulation-linearization technique. Journal of Optimization Theory and Applications ~99, 481–507 (1998) · [Zbl 0911.90328](#) · [doi:10.1023/A:1021734613201](#)
- [11] Tawarmalani, M.: Inclusion certificates and disjunctive programming. presented in Operations Research Seminar at GSIA, Carnegie Mellon University (2006)
- [12] Tawarmalani, M.: Inclusion certificates and simultaneous convexification of functions. Mathematical Programming (2010) (submitted)
- [13] Vandembussche, D., Nemhauser, G.L.: A polyhedral study of nonconvex quadratic programs with box constraints. Mathematical Programming ~102, 531–557 (2005) · [Zbl 1137.90009](#) · [doi:10.1007/s10107-004-0549-0](#)

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