Mixed-Integer Geometric Programming

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1 From GP to MIGP

gp standard form and convex form [1], example - aircraft wings [2]

gp with integer variables, example - gate sizing [1]

2 MIDCP Formulation of MIGP

dcp [5], midcp [4]

migp in conic form

selection of log-integer variables not MIP-representable

assuming bounds, disjunctive constraint formulations

3 Solution Algorithm

solve migp like other midcp problems with pajarito, an outer approximation alg [4]. can migp have unbounded feasible set? would cause problems for pajarito

find (and perhaps improve during iterations) bounds on the log-integer variables (tighter bounds led to significant speed up and avoids ECOS numerical issues, for gate sizing example)

4 Examples and Results

small gate-sizing problem

approximate nonconvex functions piecewise, extend Woody paper [3]

Woody aircraft example

5 Future Work

disjunctive formulations in the MILP - what encodings are best

unbounded log-integer variables

cuts to the MILP or to the GP

mixtures of cones

References

[1] Boyd, Stephen, et al. "A tutorial on geometric programming." Optimization and engineering 8.1 (2007): 67-127.

[2] Hoburg, Warren, and Pieter Abbeel. "Geometric programming for aircraft design optimization." AIAA Journal 52.11 (2014): 2414-2426.

[3] Hoburg, Warren, and P. Abbeel. "Fitting Geometric Programming Models to Data." Optimization and Engineering (2014).

[4] Lubin, Miles, et al. "Extended Formulations in Mixed-integer Convex Programming." arXiv preprint arXiv:1511.06710 (2015).

[5] Grant, Michael, Stephen Boyd, and Yinyu Ye. *Disciplined convex programming.* Springer US, 2006.