Polyhedral relaxations for constraint satisfaction problems

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March 22, 2013

Abstract

We consider a constraint satisfaction problem described by a system of nonlinear equations and inequalities, and the objective is to tightly enclose the set of all solutions. However, the ideas described below can easily be adapted for global optimization as well.

We present a polyhedral relaxation method based on interval linear programming approach [1]. First, we linearize the constraints to get an interval linear system of equations and inequalities. Then, we adapt techniques from interval linear programming to find a polyhedral relaxation to the solution set. The linearization depends on a selection of the relaxation center; we discuss various choices and give some recommendations. The overall procedure can be iterated and thus serves as a contractor. Since linear programming works efficiently and the polyhedral relaxation is cheap to calculate, the method is in particular convenient in higher dimensions, for which the classical approaches are too computationally expensive. We compare our approach with other linear and polyhedral relaxation techniques and show its efficiency. Finally, we state some directions for future research and open problems concerning our approach.

References

[1] M. Hladík and J. Horáček. *Interval linear programming techniques in constraint programming and global optimization*, submitted to LNCS, 2013.

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