MIP models for MIP heuristics

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Abstract

Modern MIP solvers exploit a rich arsenal of tools to attack hard problems, some of which include the solution of LP models to control the branching strategy (strong branching), the cut generation (lift-and-project), the heuristics (reduced costs), etc. As a matter of fact, it is well understood by the OR community that the solution of very hard MIPs can take advantage from the solution of a series of "collateral" LPs intended to guide the main steps of the MIP solver. Also well known is the fact that, for easy MIPs, finding good-quality MIP solutions may require a computing time that is just comparable to that needed to solve its LP relaxation. In this context, our idea is to use MIP models, instead of just LPs, to guide the MIP solvers in its most crucial steps, thus bringing MIP technology well inside the MIP solver itself.

In this talk we will elaborate upon the above idea of "translating into a MIP model" (MIPping) some crucial decisions to be taken within a MIP algorithm. In particular, we will address the possible benefits deriving from the use of an black-box MIP solver to produce heuristic primal solutions for a generic MIP. We will first review the so-called *local branching* [1] and *RINS* [2] paradigms that use the black-box MIP solver to explore large solution neighbourhoods defined through the introduction in the MIP model of very simple invalid linear inequalities (local branching cuts, or just variable-fixing constraints). We then address more sophisticated MIP models to be used to construct large-scale neighborhoods to be explored effectively by the black-box MIP solver. Preliminary computational results will be presented.

References

[1] M. Fischetti, A. Lodi. Local Branching. Mathematical Programming 98, 23-47, 2003.

[2] E. Danna, E. Rothberg, C. Le Pape. Exploring relaxation induced neighborhoods to improve MIP solutions. Mathematical Programming 102, 71-90, 2005.