On Solving a Hard Quadratic
3-Dimensional Assignment Problem

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Abstract: We address the exact solution of a very challenging (and previously unsolved) instance of the quadratic 3-dimensional assignment problem, arising in digital wireless communications. The paper describes the techniques developed to solve this instance to proven optimality, from the choice of an appropriate mixed integer programming formulation, to cutting planes and symmetry handling. The proposed techniques yield a solution procedure which is exact in nature: we decompose the original instance into subproblems based on symmetry arguments (which are symbolic, and thus exact, in nature), and then we formulate each subproblem as mixed-integer programming (MIP) program, to be solved with a complete method such as branch-and-cut. Each MIP is solved by a careful selection of formulation (lightweight KB model) and cutting plane separators (based on sub-MIPs). Using these techniques we were able to solve the target instance with moderate computational effort (2.5 million nodes and one week of computations on a standard PC).

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