Multi-mode resource constrained project scheduling using RCPSP and SAT solvers

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Abstract

This paper reports on a new solution approach for the well-known multi-mode resource-constrained project scheduling problem (MMRCPSP). This problem type aims at the selection of a single activity mode from a set of available modes in order to construct a precedence and a (renewable and non-renewable) resource feasible project schedule with a minimal makespan. The problem type is known to be NP-hard and has been solved using various exact as well as (meta-)heuristic procedures.

The new algorithm splits the problem type into a mode assignment and a single mode project scheduling step. The mode assignment step is solved by a satisfiability (SAT) problem solver and returns a feasible mode selection to the project scheduling step. The project scheduling step is solved using an efficient meta-heuristic procedure from literature to solve the resource-constrained project scheduling problem (RCPSP). However, unlike many traditional meta-heuristic methods in literature to solve the MMRCSP, the new approach executes these two steps in one run, relying on a single priority list. Straightforward adaptations to the pure SAT solver by using pseudo boolean non-renewable resource constraints has led to a high quality solution approach in a reasonable computational time. Computational results show that the PSPLIB problem instances can be solved better than the current best procedures from literature.

Key words: project scheduling, SAT, multi-mode RCPSP

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