UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

TWEEKERKENSTRAAT 2
B-9000 GENT
Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

WORKING PAPER

Multi-mode resource constrained pro ject scheduling using RCPSP and SAT solvers

José Coelho*

Mario Vanhoucke†

October 2009

2009/614

* Technical University of Lisbon, Av. Rovisco Pais 1049-001, Lisbon, Portugal and Universidade Aberta, Rua da Escola Politcnica, 147, 1269-001, Lisbon, Portugal
† Faculty of Economics and Business Administration, Ghent University, Tweekerkenstraat 2, 9000 Gent (Belgium), mario.vanhoucke@ugent.be

D/2009/7012/66

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

José Coelho* and Mario Vanhoucke†

October 5, 2009

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 a 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 MMRCPSP, 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

*Technical University of Lisbon, Av. Rovisco Pais 1049-001, Lisbon, Portugal and Universidade Aberta, Rua da Escola Politcnica, 147, 1269-001, Lisbon, Portugal.

†Ghent University, Tweekerkenstraat 2, B–9000 Gent, Belgium and Vlerick Leuven Gent Management School, Reep 1, B–9000 Gent, Belgium.