Time Index Variable Formulation Applied to Oversubscribed Scheduling

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In many applications, coming in their majority from the space-aeronautic industry, the faced scheduling problems are *oversubscribed*. What this means is that not all tasks can be included in the schedule considering the given resources. For example, the problem of scheduling satellite image acquisitions based on science requests [1], [5], [6],

The usual approaches to get solutions of these problems come from AI-Scheduling field or from combinatorial optimization [3], [4]; being an heuristic approach named *Squeaky Wheel Optimization* (SWO) one of the most populars [2].

In this work, we explore the use of the so called *Time Index Variables* (TIV) *Mixed Integer Programming* (MIP) formulation [7] to solve oversubscribed scheduling problems. To do so, we adapted the TIV model to handle the specifics of oversubscribed scheduling problems and run it on a set of benchmark problems.

The results are very promising and allow us to conclude that in the case of lightly oversubscribed problems, the TIV MIP formulation can handle the problems very quickly. It allows to find optimal solutions even for very large instances, which nowadays makes it one of the best techniques available.

For heavily oversubscribed scheduling problems TIV MIP formulation is able to handle large instances in reasonable time. And even in the cases were no optimal solution is found, the convergence to an approximating solution of reasonable quality is fast.

With the solutions found, we can also conclude that SWO heuristic algorithm is able to find near optimal solutions only for lightly oversubscribed problems.

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