Invitation à la soutenance publique de thèse
Pour l’obtention du grade de Docteur en Sciences de l’Ingénieur

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Constraint Programming Algorithms and Models for Scheduling Applications

Time-related optimization problems are very hard to solve. Scheduling covers a subcategory of such problems where the goal is to place events in time. The discretization of time triggers a rapid growth of possible placements. While scheduling problems were already computationally solved two decades ago, large real-world sized instances seemed to be out of reach back then. The recent gain of computational power brought by modern computers is not large enough to counter the combinatorial explosion of these problems. However, new promising resolution techniques have emerged, such as Constraint Programming (CP). This paradigm allows to express declaratively discrete constrained optimization problems.

This thesis achieves two main goals. First, we design new abstractions and techniques to enrich the set of tools CP can use to solve Scheduling problems. Second, we prove that CP is able to solve large instances of real-world scheduling problems in short amounts of time.

Several new scheduling abstractions for CP are introduced in this thesis, including two new propagation procedures. Propagation is a CP mechanism that allows to remove parts of the search space that are provably unfeasible. The first propagation procedure introduced performs Forward-Checking propagation for the Nested Global Cardinality Constraint (Nested GCC). The second propagation procedure is designed for a new constraint: the unary resource with transition times.

We apply CP scheduling resolution techniques on four industrial problems. These four problems take place in two main sectors of activity: medical treatment centers and industrial production. These four problems have been solved on either realistic generated instances or on historical instances. By coupling CP with Large Neighborhood Search, a diversification strategy, we have been able to provide high quality solutions to these four problems.

Membres du jury :
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