琉球大学学術リポジトリ

ペトリネットに基づく数理計画の生成と反復型最適化手法に関する研究

メタデータ	言語: 出版者: 琉球大学 公開日: 2019-05-22 キーワード (Ja): キーワード (En): 作成者: 天願, 健, Tengan, Takeshi メールアドレス: 所属:
URL	http://hdl.handle.net/20.500.12000/44478

（様式第３号）

論　文　要　旨

論　文　題　目

A Study on Petri Net-based Formulation and Iterative Optimization for Integer Linear Programming

This thesis proposes a Petri net-based formulation of mathematical programming problems and iterative optimization.

Firstly, we propose a Petri net based mathematical programming approach to combinatorial optimization, in which we generate integer linear programming problems from Petri net models instead of the direct mathematical formulation. We treat two types of combinatorial optimization problems, ordinary problems, and time-dependent problems.

For ordinary problems, we present autonomous Petri net modeling, where we obtain fundamental constraints derived from Petri net properties and additional problem-specific ones. For time-dependent problems, we propose a colored timed Petri net modeling approach, where we generate variables and constraints for time management and for resolving conflicts. Our Petri net approach can drastically reduce the difficulty of the mathematical formulation since (1) the Petri net modeling does not require deep knowledge of mathematical programming and technique of linear model formulations, (2) our automatic formulation allows us to generate large size of integer linear programming problems, and (3) the Petri net modeling approach is flexible for input parameter changes of the original problem.

Secondly, we present an iterative optimization algorithm based on mathematical programming for large-scale integer linear programming problems. The algorithm reduces the size of mathematical programming problems by setting values to the variables specified by our Monte-Carlo algorithm so that a solver could solve the reduced problem. The iterative process of reducing the problem and solving the reduced problem cannot make the solution quality worse from the previous one, that is, our algorithm can improve iteratively the solution quality. The experimental evaluation shows the effectiveness of our algorithm, where our approach can obtain a good quality of solutions in reasonable computation time for hard integer linear programming problems such that the exact solver requires extremely long computation time.

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