Fix-and-optimize and variable neighborhood search approaches for Multi-Level Capacitated Lot Sizing Problems

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Fix-and-Optimize and Variable Neighborhood Search Approaches for Multi-Level Capacitated Lot Sizing Problems

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Abstract: In this paper, a new fix-and-optimize (FO) approach is proposed for two dynamic multi-level capacitated lot sizing problems (MLCLSP), the MLCLSP without setup carryover and the MLCLSP with setup carryover. Given an MIP model of a lot sizing problem, the approach iteratively solves a series of sub-problems of the model until no better solution can be found. Each sub-problem re-optimizes a subset of binary decision variables determined based on the interrelatedness of binary variables in the constraints of the model, while fixing the values of the other binary variables. Based on the FO, a variable neighbourhood search (VNS) approach for the MLCLSP without setup carryover is also developed, which can further improve the solution obtained by the FO by diversifying the search space. Numerical experiments on benchmark instances show that both our FO and VNS approaches can obtain a better solution for most instances compared with that found by the fix-and-optimize approach proposed by Helber and Sahling (Int. J. Production Economics, 123 (2010), 247–256).

Keywords: Production planning; lot sizing; fix-and-optimize; variable neighbourhood search, mixed integer programming

1. Introduction

Production planning is one of the most important decisions for manufacturers. It determines how many units of each component/final product should be produced internally or procured from outside suppliers in each period over a given planning horizon, with the objective to minimize the total cost, while meeting customer demand on time. In most enterprise resource planning (ERP) systems, production plans are made using backward scheduling without considering resource

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