The Use of Meta-heuristics to Solve Economic Lot Scheduling Problem

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Abstract. Economic lot scheduling problem has been an important topic in production planning and scheduling research for more than four decades. The problem is known to be NP-hard due to its combinatorial nature. In this paper, two meta-heuristics algorithms - Tabu Search and Simulated Annealing - are proposed. To investigate the effect of control parameters to the performance of tabu search and simulated annealing algorithms, a general factorial design of experiment study is used. Two Neighborhood Search heuristics that differ in rounding off scheme of the production frequencies are also tested. Experimental study shows that both tabu search and simulated annealing algorithms outperform two best known solution methods - Dobson's Heuristic and Hybrid Genetic Algorithm.

1 Introduction

Economic Lot Size Problem (ELSP) deals with the production assignment of several products sharing a common production facility in order to minimize the total cost. It is a constraint optimization problem where production scheduling is done in such a way that all products are manufactured and their demands are satisfied during the planning period. There have been many articles published in last forty years covering a wide range of possible solutions to ELSP. The problem has many applications in production planning and scheduling (see Moon et al. [1]). The earliest contribution to ELSP is due to Elbon [2], Rogers [3], Maxwell [4], Hansmann [5] and Bomberger [6]. A Lower Bound (LB) on cost was developed by Bomberger [6]. The LB is tight because it incorporates machine sharing constraint in calculation, whereas the previous lower bound was an Independent Solution (IS) obtained by ignoring all constraints. Elmaghraby [7] presents a comprehensive review of the research up to late 1970s. In previous studies, three different approaches are used to solve ELSP: common cycle, basic period and time varying lot size. In all approaches it is mostly desired to generate cyclic schedules and Zero Switch Rule (ZSR) is also considered in most studies. ZSR enforces the condition that a product will only be produced if it's inventory reaches to zero. ZSR does not guarantee optimality as it is shown in some cases (see Maxwell [4] and Delporte and Thomas [8]). A common period