Bi-criteria Scheduling in an Assembly Flow Shop with Limited Buffer Storage and Shift Production

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Abstract

In this research, the comparative performance of permutation (PN) and non-permutation (NPN) schedules is investigated in an assembly flow shop with shift production, where a limited buffer storage is available between two machines. The production occurs in 8-hour shifts and a constraint is placed on the number of shifts that the plant can operate each day. A non-continuous production is encountered in the case of one or two shifts per day operation. The objective of the problem is to minimize the linear combination of total setup time and weighted tardiness. Since these two objectives are not evaluated on a commensurate basis, a normalization factor is used. The problem is formulated as a mixed-integer linear programming model and solved using CPLEX for small problem instances. Since the problem is NP-hard, two algorithms each, are developed for PN and NPN schedules. The first algorithm uses tabu search based only on short-term memory whereas the second algorithm incorporates tabu search into the framework of path relinking technique. A statistical designed experiment is conducted to evaluate the difference in performance of the developed algorithms. The evaluations show that the developed heuristics obtain good quality solutions within much less computational time as compared to CPLEX. Also, the TS/PR algorithms were found to outperform short-term TS for medium and large problem instances. A slight improvement of 1.64% was obtained by adopting the NPN sequence over the PN sequence. However, the analysis shows that the improvement is not statistically significant. Hence, it is recommended that only PN sequences be considered for the research problem because of its higher efficiency and comparable effectiveness.

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