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MINIMIZING PRODUCTION FLOW TIME IN A PROCESS AND ASSEMBLY JOB SHOP

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ABSTRACT

The research to date on assembly shop scheduling is considerably less extensive than the body of traditional job shop research, even though most jobs realistically involve assembly of some sort. Unlike simple job shops, no predominant sequencing rule has been determined for assembly shop scheduling. In this research, the problem of production scheduling in a single factory is addressed. To solve this problem, a mathematical model is formulated based on a given scheduling strategy. The objective of the model is the minimization of total production flow time (makespan). A heuristic algorithm is then developed to solve the model more efficiently. The solution obtained from the model provides a production plan for getting products through the system in a timely manner.

Keyword: Assembly shop scheduling

INTRODUCTION

Research in the deterministic production assembly job shop has been less extensive than that of the more simplified job shop. The primary reason is that in the assembly job shop there are precedence relations between jobs as well as operations, while in the general job shop there is only precedence between operations. Because of the computational complexity and the fact that the generation of optimal schedules is likely to require excessive computational time, independent of the methodology, the pursuit of "pure" optimal scheduling method is impractical. This means that the primary challenge faced by researchers is to developed an efficient solution methodology that generates near-optimal solutions with measurable performances.

Chen and Wilhelm (1993) presented a heuristic for the kitting problem in a multi-echelon assembly system. The objective was to allocate on-hand stock and anticipate future deliveries to kits to minimize total cost, consisting of job earliness, job tardiness, and in-process holding costs. The heuristic was shown to run in polynomial time in the worst case and appeared to be well suited for large scale industrial problems. A different work in the solution approach (based on integer programming model) was also presented (Chen and Wilhelm, 1994).

Doctor et al (1993) presented a model for scheduling in a job shop with assembly considerations. The objective pursued in the development of the model was maximizing the machine utilization subject to satisfying job due date requirement. A heuristic algorithm based on slack time and extra time was developed to solve the problem. The main conclusion by the authors was that the need to coordinate the completion time of components becomes much more critical in a high loads job shop. The disadvantage of this model is that the results obtained is only good for tree structure (BOM) with less than or equal to three levels.

Dimyati et al (2004) presented a Mixed Integer Linear Programming (MILP) model for scheduling in an assembly job shop to minimize total production flow time. The model was developed under the strategy where identical sub-jobs are consolidated or aggregated into super batches for processing. The main conclusion of the study was that the MILP model developed is computationally intensive as the number of jobs and integer variables increased.