A new method for decreasing cell-load variation in dynamic cellular manufacturing systems

ABSTRACT

Cell load variation is considered a significant shortcoming in scheduling of cellular manufacturing systems. In this article, a new method is proposed for scheduling dynamic cellular manufacturing systems in the presence of bottleneck and parallel machines. The aim of this method is to control cell load variation during the process of determining the best trading off values between in-house manufacturing and outsourcing. A genetic algorithm (GA) is developed because of the high potential of trapping in the local optima, and results are compared with the results of LINGO® 12.0 software. The Taguchi method (an L_9 orthogonal optimization) is used to estimate parameters of GA in order to solve experiments derived from literature. An in-depth analysis is conducted on the results in consideration of various factors, and control charts are used on machine-load variation. Our findings indicate that the dynamic condition of product demands affects the routing of product parts and may induce machine-load variations that yield to cell-load diversity. An increase in product uncertainty level causes the loading level of each cell to vary, which in turn results in the development of "complex dummy sub-cells". The effect of the complex sub-cells is measured using another mathematical index. The results showed that the proposed GA can provide solutions with limited cell-load variations.

Keyword: Facilities planning and design; Cell Scheduling; Cell Load Variation; Part Routing