Efficient Implementation of the p-Median Model for Solving the GT Cell Formation Problem

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Abstract

This paper considers the machine-part cell formation(CF) in Group Technology(GT) manufacturing. Among various approaches dealing with the problem, mathematical programming approach attempts to find machine cells and part families by formulating the problem into linear or nonlinear programming models. Kusiak(1987) suggested an linear integer programming model, called the p-median model, seeking to maximize the sum of similarity coefficients defined between pairs of parts. Since the author suggested using the p-median model as a methodology for solving CF problem, many authors have reported successful applications to cell configuration with slight modifications over the original formulation(Ribeiro and Pradin 1993, Viswanathan 1996, Wang and Roze 1997, and Deutsch et al. 1998). Existing p-median formulations, however, have critical limitation in that the formulations can only be applied to small CF problem because existing p-median formulations take prohibitive computation time to complete implementation. This paper proposes an efficient scheme for implementation of the p-median model in CF stage. New p-median implementation scheme is based on slight modification of the original formulation. Unlike exsisting schemes seeking to find the median elements among all the machine entries, new scheme attempts to find the median elements among restricted entries of machines which are selected as candidate medians because it is strongly conjectured that those little associated with lowest similarity scores tend to form medians for clustering machines around those medians. This procedure is easily implemented with existing information of similarity scores. Furthermore, a single constraint is added assuring that the values of remaining binary variables not associated with the median elements keep zero. These modifications encourage speedy implementation of the p-median model. Computational experience shows significant efficiency of new p-median implementation scheme over existing ones.