

# PART-MACHINE GROUP FORMATION WITH ORDINAL-RATIO LEVEL DATA & PRODUCTION VOLUME

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## Abstract

This work presents an algorithm for design of cellular manufacturing system. It considers ordinal level data and ratio level data. We consider sequence of operation for every component as ordinal level data. The ratio level data includes operation time per unit, production volume & machine capacity. Adapted design activity model & image representation in computer vision is used to model ordinal-ratio level data. Orthographic view part grouping is used for part family formation. Machines are allocated on basis of their net utilization for a part family. Performance of algorithm is comparable & of good quality with existing methods in its class. To validate the result, a two way ANOVA technique is used, and on simulated example the F-ratio is enumerated. It is observed that production volume has significant influence on cell configuration and cell performance. It is concluded that the change in production volume mixes may need reconfiguration & capacity scaling according to recommendation of algorithm & ANOVA analysis. To facilitate industrial application, it can be implemented by using free software, Scilab and/or commercial softwares.

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**Key Words:** Cellular Manufacturing, Part Families and Machine Cells, Algorithm, ANOVA

## 1. INTRODUCTION & LITERATURE REVIEW

Cellular Manufacturing (CM) is an application of group technology. It aims at a harmonious assimilation of manufacturing facilities of a company. It relies on manufacturing similarity concept of group technology. It allows the benefit of flow production organization to be obtained in a job shop or batch shop production. The first step towards the design of a cellular manufacturing system is the identification part families and machine groups. The more closely the assumption made are to reality (i.e. shop floor realities), the better the cell design.

Most methods are based on machine component incidence matrix (that is 0 & 1) alone [1-11]. A number of researchers proposed similarities coefficients based approaches to solve the CF problem in the literature. An approach is proposed that is based upon the calculation of an average voids value (AVV), which indicates the average number of newly produced voids, when a pair of machine groups is combined [12]. Studies indicated that similarity coefficients based methods (SCM) are more flexible than other CF methods [13].

Some components have to travel to another cell for further operations. Different order/sequence of machine cells allocation may result in different total intercellular distance unit. If the production volume of each part is very large, then the total number of intercellular movement will be further larger. Therefore, operation sequence and production volume are very important production factor [11, 14, 15]. Beside it, capacity is other important shop floor parameter, influencing progress of part production and cell performance [16].

Venugopal & Narendran made use of genetic algorithm for clustering. Nair & Narendran developed a method (CASE, 1998) [15] of the non-hierarchical type on the basis of sequence

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