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Review Article

GROUP TECHNOLOGY IN CONTEXT OF THE PRODUCT CLASSIFICATION

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ABSTRACT
In the intensive competitive environment of the global economy, the survival of even the most well-established the world manufacturers depends on the ability to improve continuously quality while reducing costs. The resulting higher productivity is the key to market leadership and gaining sustainable competitive advantage. This paper outlines a group technology and classification of products which improve productivity, quality, inventory management of a company and reduce production times.

Keyword: group technology, classification and coding system, cellular manufacturing, products analysis, cluster analysis, segmentation, capacity planning.

INTRODUCTION

A typical company makes thousands of different parts, in many different batch sizes, using a variety of different manufacturing operations, processes and technologies. It is beyond the capability of human mind to comprehend and manipulate such vast amounts of detailed data. People still need to make decisions regarding how to run a manufacturing company and succeed in today‘s competitive environment on home and foreign markets. The pressures on management continue to escalate as global competition drives the need for producing a greater variety of high quality products, in smaller lot sizes and at lower costs. These ongoing demands continuously increase the level of complexity present in a manufacturing environment. What is needed is both a strategy and a tool that can be used to achieve such a purpose.

The layout design of a manufacturing facility is one of the most important factors affecting product quality and cost. The manner in which the equipment is configured on the shop floor affects material flow, manufacturing leadtimes, work in-process inventories, in-process quality and the manner in which work is scheduled, processed and controlled throughout the production.

GROUP TECHNOLOGY (GT)

GT is a processing philosophy based on a principle that similar products should be processed similarly. The basic idea of GT is to decompose a manufacturing system into subsystems. It reduces production lead time; work-in process; labour; tooling; rework; scrap material; set-up time; delivery time; and paper work. The idea behind GT is to improve efficiencies by exploiting similarities. The application of GT influences time power of operation, WIP inventory, material handling, job satisfaction, jig and fixture, set up time, required space, quality, finished product and labor cost. This concept has been successfully employed in cellular manufacturing in which, parts with similar processing requirements are identified and grouped into part families, and then machines with different processing capacities are placed within a cell (Figure 1).

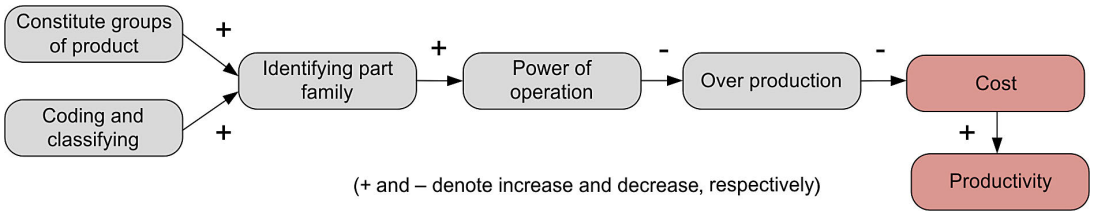

Fig. 1. The impact of part family (grouping, classifying and coding) on manufacturing system – Extracted and modified from Ham et al. [1985]

Groups of products are the number of products that have the similar design characteristics or similar manufacturing processes. Grouping the products is an important step in the use of this technique. Four main methods for grouping products include manual/visual search; nomenclatures/functions; production flow analysis and classification and coding of the system.

The principle of group technology is to divide the manufacturing facility into small groups or cells of machines. The term cellular manufacturing is often used in this context. Each of these cells is dedicated to a specified family or set of part types. Typically, a cell is a small group of machines (as a rule of thumb, not more than five). An example would be a machining centre with inspection and monitoring devices, tool and Part Storage, a robot for part handling, and the associated control hardware.

GROUP TECHNOLOGY AND CLASSIFICATION SYSTEMS

Group technology principles may be applied to any conceivable entity ranging from manufactured parts and capital equipment to decision processes and human characteristics [Wemmerlov and Hyer 1992]. GT aims to take advantage of similarities that exist among items, and to increase the effectiveness by:

- allowing similar, recurring activities to be conducted together;
- standardizing similar activities to control activity proliferation and better utilize resources (e.g. control over new designs);
- supporting convenient information retrieval so that historical information is accessible and usable (e.g. retrieval and modification of an old process plan to suit a newly designed part released to manufacturing).

A part family is a collection of similar parts that share specific design and/or manufacturing characteristics, identified for a well-defined purpose (Figure 2). All parts in a family may require similar treatment and handling methods, and efficiencies are achieved by processing the parts together. Manufacturing efficiencies are gained from reduced set-up times, part family scheduling, improved process control, standardized process plans, standardized instructions, group layouts, higher quality, and in general, increased learning. Product design advantages are gained when design engineers retrieve existing drawings to support new products and when features are standardized to prevent part proliferation.

*T*hree types of activities are necessary in applying group technology:

- determination of critical part attributes that represent the criteria for part family membership;
- allocation of parts to established families;
- retrieval of part family members and related information.

CLASSIFICATION SYSTEMS

The classification is defined as a process of grouping parts into families based on some set of rules and principles. This approach can be further categorized into a visual method and coding procedure. Grouping done based on the ocular method is a process of identifying part families by visually inspecting parts and assigning them to families and the production cells to which they belong.

This approach is limited to parts with large physical geometries and it is not an optimal approach since it lacks accuracy and sophistication. This approach becomes inefficient as the number of parts increases.

A well-designed classification and coding system may result in several benefits for the manufacturing plant. A part is a code that can consist of a numerical, alphabetical or alphanumerical string.

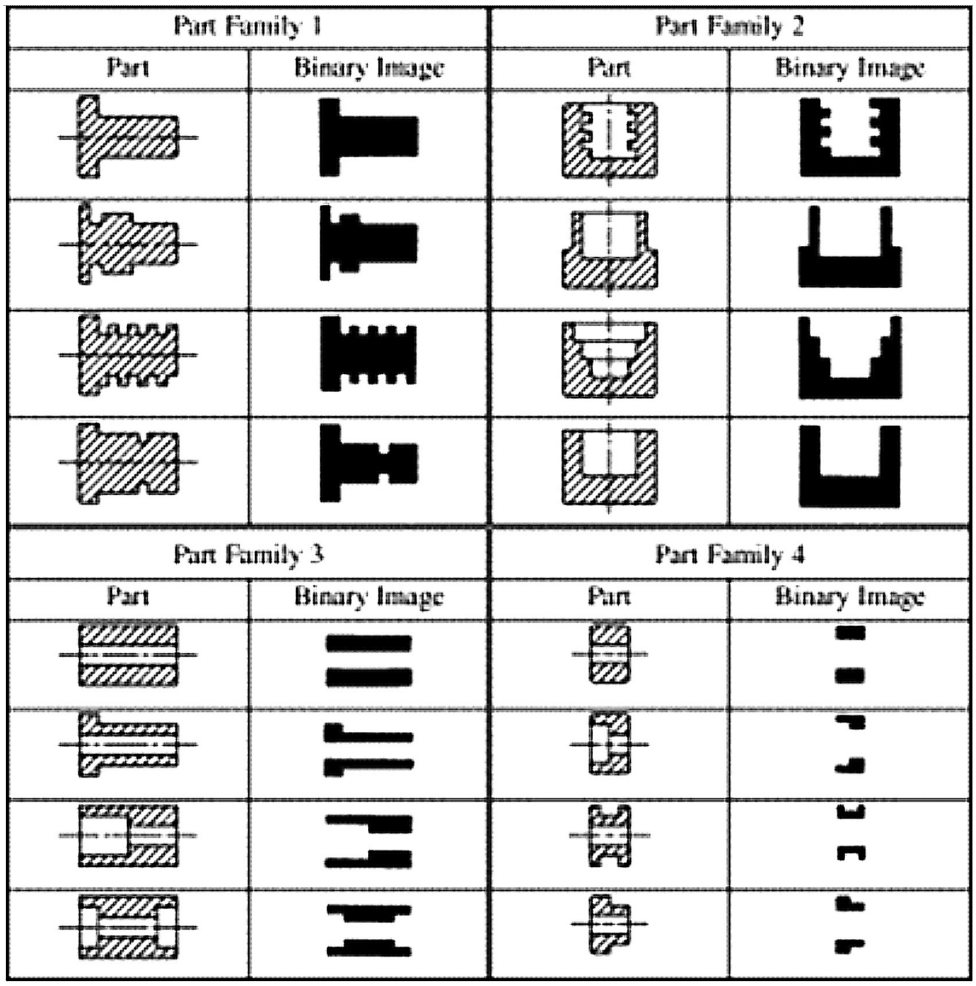

Fig. 2. Four part families and their corresponding binary images

Tree types of coding systems exist:

- **Hierarchical (monocode) structure:** each character (code) is a further expansion of the previous character. This indicates that the meaning of the code is dependent on the meaning of the previous character in the code´s string. The advantage of this approach is the amount of information which the code can represent in a relatively small number of digits. However, a coding system based on this structure is complicated and very difficult to implement.
- **Chain (attribute, or polycode) structure:** the meaning of each character (code) is independent from any other character within the code string. In this approach, each attribute of a part is tagged with a specific position in the code. This structure is simple to implement, but a large number of digits may be required to represent characteristics of a part. An example of this coding structure is MICLASS – it is a 12-digit coding system based on the design attributes of parts.
- **Hybrid:** most of the available coding systems are implemented using this type of structure. A hybrid coding system is a combination of both monocode and polycode structures, taking advantage of the characteristics of the two previously described structures. Examples of this coding structure are the OPITZ coding system and KAMKODE.

CONCLUSSION

Grouping parts into families is a tedious task which requires careful planning and consideration. Basic methods which are available for solving the GT problems in manufacturing can be classified into: classification, production-flow analysis, and cluster analysis. The usage of GT systems and product classification can increase control over both, the design and the manufacturing stages. It provides highly accurate and effective information to management, which will contribute to high productivity and cost saving.

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