A Review: An Importance of Group Technology in Automation Engineering

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Abstract:
In today’s competitive market improving productivity is of great concern for any Manufacturing Industry. The production process requires a variety of machines and often some complex procedures. Frequently, parts have to be moved from one place to another. These results not only in machine idle time but also wastes the manpower required for the physical movement of the parts. In this situation, more setup changes and frequent part or machine movements occur. So Group Technology is useful for increasing productivity, it assembles simply design & reduce cost of tools & Equipment. In this paper identifying The part family through production flow analysis (PFA), it uses a matrix of part numbers and machine numbers to group families. The concept of GT is related to numerical control machine and it is used in part programming.

Keywords: Production Flow Analysis (PFA), Part Family, Numerical Control (NC) Machine. Coding System.

I. INTRODUCTION:

Today’s Production engineers continuously adapt state-of-the-art techniques and methodologies in order to achieve this goal. Profit in manufacturing can be achieved by lowering Costs and improving product quality. The production process requires a variety of machines and often some complex procedures. The two parts that may be identical in shape and size but are quite different in manufacturing, , On the other hand there are ten parts that are different in size and shape, but quite similar in terms of manufacturing; all parts are machined from cylindrical stock by turning; some parts require drilling and/or milling Certain problems linked with the GT
1) Identifying the part families.
2) If the plant makes 10,000 different parts, reviewing all of the part drawings and grouping
   The parts into families are a substantial task.
3) Rearranging production machines in the plant into the appropriate machine cells.
4) It takes time to plan and accomplish this rearrangement, and the machines are not producing during the changeover.
Classification and coding systems can provide a structure for the classification of parts into groups based on selected part attributes, and by assigning a code to each part. This code aids information retrieval for that part. A code is a string of alphanumeric characters which, when interpreted, provides information about that part

II. LITERATURE REVIEW

Burbidge (1991) Classification and coding (Classification & Coding) may have value in some companies as a route towards standardization or as a technique for reducing drawing office ortooling costs. It is, however, a very inefficient method for finding groups and families for GT. Tatikonda and Wemmerlov, (1992) Part Family is a group of parts that possess similarities in geometric shape and size, or in the processing steps used in their manufacture.

Yang and Yang (2008) are of the opinion that Group technology (GT) has proven to be a useful way of addressing these problems by creating a more flexible manufacturing process. It can be used to exploit similarities between components to achieve lower costs and increase productivity without losing product quality. Rad (2010) reported that GT examines products, parts and assemblies and then groups similar items to simplify design, manufacturing.. This technology benefits design and manufacturing functions in many ways. It reduces the time needed for preparing engineering drawings for similar parts, and reduces the cost and time needed for designing auxiliary machining equipment such as special cutting tools; Shahin & Janatyian (2010) Groups of product 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.

II. PART FAMILY IN GT

The two parts that may be identical in shape and size but are quite different in manufacturing, Refer Fig-01. On the other hand there are ten parts that are different in size and shape, but quite similar in terms of manufacturing; all parts are machined from cylindrical stock by turning; some parts require drilling and/or milling Refer Fig-02. [E1]

Figure 1. Parts identical in but are b) Figure 2. Parts different in quite different in manufacturing. Shape similar in Mfg.
Composite part in a part family can be elaborated as: [E1]
1) A composite part for a given family is a hypothetical part that includes all of the design and manufacturing attributes of the family.
2) In general, an individual part in the family will have some of the features of the family, but not all of them Refer Fig-03.
3) A production cell for the part family would consist of those machines required to make the composite part.

GT can be overviewed as follows: [E1]
1) GT minimizes the disadvantages of such as Downtime for changeovers high inventory carrying costs by recognizing that although the parts are different, there are groups of parts that possess similarities.
2) GT exploits the part similarities by utilizing similar processes and tooling to produce them.
3) GT can be implemented by manual or automated techniques.
4) When automated, the term *flexible manufacturing system* is often applied.

IV. CLASSIFICATION AND CODING SYSTEMS IN CONTEXT OF GT:

Most classification and coding systems are one of the following: [E2]
1) Systems based on part design attributes.
2) Systems based on part manufacturing attributes.
3) Systems based on both design and manufacturing attrib
Part Design Attributes
1) Basic external shape
2) Basic internal shape
3) Length/diameter ratio
4) Material type
5) Part function
6) Tolerances
7) Surface finish

Some of the important classification and coding system are mentioned below: [E1]
1) Optiz Part classification and coding System
2) Brisch System
3) CODE

CUTPLAN
Basic structure of the Optiz Part classification and coding System is summarized below
Refer Table-01, Fig-04 & Fig-05.: [E1]
V.PRODUCTION FLOW ANALYSIS AS A KEY STEP FOR IDENTIFYING THE PART FAMILY IN GT:

Classification & Coding PFA says: "PFA takes a more direct approach, saying: "Parts which are made using the same set of machines can be made in the same group." Another difference is that PFA is a technique for simplifying material flow systems. Classification & Coding ignores this aspect of the problem. PFA consists of five sub-techniques used progressively to simplify that material flow system in an enterprise.

1) Company flow analysis (CFA). The first analyzes the existing flow of materials between the different factories in a large company and develops a new, simpler and therefore more efficient system in which each factory completes all the parts it makes. Factory Flow Analysis (FFA). The second studies each factory in turn. It plans the division of the factory into major groups or departments each of which completes all the parts it makes. Production Flow Analysis (PFA) uses a matrix of part numbers and machine numbers to group families. In the matrices below, columns represent the machines whose numbers and names are at the top. Rows represent parts whose numbers and names are on the left. When a particular part requires a particular machine, the operation sequence number is in the intersecting spreadsheet cell. Sometimes, merely an "X" signifies that a particular part needs a particular machine. Most part families have a "natural sequence." For example "Lathe" normally precedes "Deburr." This natural sequence dominates and becomes the basis for the workcell layout. You can usually ignore sequence issues when developing the PFA matrix. It is difficult to see order or similarity in the first matrix. Rearranging the rows and columns, as in the second matrix, clearly shows families of similar parts and the machines required to build them. These machines form a workcell Refer Fig-06 & Fig-07.

Table.2. Pump machining PFA Analysis before grouping. [E2]

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operator</th>
<th>Machine</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>50647-D</td>
<td>Gland, MU, 8&quot;</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>71928</td>
<td>Head, Pump</td>
<td>X, X</td>
<td></td>
</tr>
<tr>
<td>71972-8</td>
<td>Adapter, Intake, 8&quot;</td>
<td>X, X, X</td>
<td>Cell</td>
</tr>
<tr>
<td>81176</td>
<td>Body, Valve</td>
<td>X, X</td>
<td></td>
</tr>
<tr>
<td>72298</td>
<td>Elbow, Relief Valve</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>61367-T</td>
<td>Impeller</td>
<td>X, X</td>
<td></td>
</tr>
<tr>
<td>62966</td>
<td>Generator, Tach Pulse</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>70812</td>
<td>Gear, Driven 8P, 56T, RH</td>
<td>X, X</td>
<td>X</td>
</tr>
<tr>
<td>70935</td>
<td>Gear, Driven 8P, 26T, LH</td>
<td>Chucking, X</td>
<td>X</td>
</tr>
<tr>
<td>61354</td>
<td>Cover, Bearing</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>62584</td>
<td>Spacer, Opn Shaft</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>62575</td>
<td>Shaft, Shift</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>63160</td>
<td>Seat, Spring</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>51171</td>
<td>Retainer, Bushing</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>50763</td>
<td>Spacer, Bearing</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

2) Parts it makes, and it plans a simple unidirectional flow system joining these departments.

3) Group analysis (GA). The third uses matrix resolution to divide each department in turn into groups, each of which completes all the parts it makes. Providing that one starts with departments which complete parts, GA can, inside certain limits of group size, and with very few exceptional parts, always find groups which complete parts, with no backflow, no cross flow (between groups) and no need to buy any additional equipment.

4) Line analysis (LA). The fourth analyses the flow of materials between the machines in each group to find the information needed for plant layout.

5) Line analysis (LA). The final technique returns to matrix resolution—in this case matrices of parts and the tools they use. It studies each machine in each group in turn, in order to find "tooling families" of parts which can all be made on the machine with the same set of tools at the same setup and also to find the sequence of loading which will minimize setup times.

An example illustrating the PFA is as follows: [E2]

Tabel.3. Pump machining PFA After grouping. [E2]

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>61354</td>
<td>Cover, Bearing</td>
</tr>
<tr>
<td>70812</td>
<td>Gear, Driven 8P, 56T, RH</td>
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<tr>
<td>50763</td>
<td>Spacer, Bearing</td>
</tr>
</tbody>
</table>

VI. DISCUSSION.

GT provides, in fact, the foundation for an evolutionary approach to complete automation. Among the other advantages of GT are a reduction in throughput times and also, therefore, in the stock investment, and a better accountability possible when supervisors control all the facilities needed to complete parts and can be made responsible for quality, cost and due-date performance in their groups. With the use of PFA, it is generally possible to find a complete division of any batch or dividing production factory into groups which complete all the parts in their associated families of parts. These groups are, in effect, flexible manufacturing systems with some manual operations.

VII REFERENCES:


