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Parametric Classification For Part Grouping In Group Technology

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ABSTRACT

In this paper, we present a new method of part grouping based on actual demand of the user requirements or needs. A new algorithm is used to classify the parts dynamically and to group parts in different groups. Here we try to match non parametric values and exactly identify the difference from old parts with new orders.

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INTRODUCTION

Intuitively, if two products are similar, it is possible to reuse information about one product to derive corresponding information about the other one. There are many possible applications where reuse of information can be of significant value. Representative examples include part-family formation, redesign suggestion generation, supplier selection, cost estimation, tooling design, machine selection, stock selection, and design reuse.

1. Group Technology:

Group technology is an operations management philosophy based on the recognition that similarities occur in the design and manufacture of discrete parts. Similar parts can then be arranged into part families. To implement such a system, some form of classification of parts and coding is required. Parts classification and-coding is concerned with identifying the similarities and using these similarities to evolve a classification code. Similarities are of two types: design attributes (such as geometric shape and size), and manufacturing attributes (the sequence of processing steps required to make the part).

In companies, which employ several design engineers and manufacturing a diverse range of products, such classifications and coding has a number of other uses. One of the major benefits is avoiding the duplication of similar components. This can result in considerable savings in terms of design cost, processing cost and tooling cost. One prime necessity to realize this is to have a good design retrieval system. The parts classification and coding is required in a design retrieval system, and in computer aided process planning the process routing is developed by recognizing the specific attributes of the part and relating these attributes to the corresponding manufacturing operations.

2. Part Families:

A part family is a collection of parts which are similar either because of design and manufacturing, similar processing steps are required in their manufacture. The parts within a family are different, but their similarities are close enough to merit their identification as members of the part family.

The types of design and manufacturing attributes typically included in classification schemes are listed below Part Design Attributes and Part Manufacturing Attributes

If we take a look at a machine tool manufacturing industry, large part families can be grouped as follows:

i Heavy parts - beds, columns etc

ii Shafts, characterized by large L/D ratios

iii Spindles (long shafts, screw rods included)

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iv Non-rounds (small prismatic parts)
v Gears, disc type parts (whose L/D ratios are small)

From the manufacturing point of view, group technology can bring in considerable economy in tooling, set up time, part changeover times, machine specifications etc. The classification of components in groups can lead to formation of cells where similar components are machined. However, these considerations are extraneous to the process planning function.

Proposed Method:

A new approach consists of applying methods, which enable the dynamic grouping of the engineering parts in the individual groups according to selected criterions (e.g.cost, precision, equipment, level of automation, etc.).

Problem Definition:

To identify the sensitivity of optimum solution to problem parameters. When a problem parameters changes by a small amount i.e consider the minimum weight design of a machine component of structure subject to constrain on the induce stress. After solving the problem, we may like to find the effect of changing the material. This means that we would like to know the change in the optimal dimension & the minimum weight of the component or structure due to change in the value of permissible stress. We use finite difference method to solve the sensitivity derivatives of changing parameters.

Design Consideration:

For example, the design of gear for a particular application is tedious problem because of so many factors such as difference in size,type,power,Pinion speed,velocity,stress,material etc.Also during gear design many criteria have been considered. The main parameters to be decide for a gear are Centre distance, module, face width, gear dia, No of teeth etc may vary according to the customer demand. These are derived using various formulae's and also using tables. The new design to classify the parts within their family based on various parameters on actual demand is easily retrieved from older design and matched with new ones and highlights the major small difference to find optimum result using finite difference method. This project is supported by industrial components and hence overall production cost has been reduced and finally work in progress & grouping efficiency has been increased.

3. Technical Approach:

This project is supported by opencv,and python coding for processing of images and match,compare.The search tool locates existing parts similar to the new part based on some geometric attributes. It creates signatures for each of the parts in the database and stores the signatures along with the solid model of the part. A signature is a list of geometric attributes that describe the part and depends on the application. These pre-computed signatures reduce the time required for comparison and, thus, improve the speed of comparison. The search tool then uses the signatures to compare the signature of the query part with each of the signatures of the database parts to determine if the parts are similar.

This method overcomes the disadvantages from feature-based modeling software such as Pro/E or SolidWorks to assess similarity between parts. We can use either design features or manufacturing features.

Advantages of our method include:

- ***Customizability:***

Our method allows the user to customize the search criteria by letting the user select the important feature characteristics that s/he wants to consider such as feature type, feature volume etc. Also the distance function used for comparison can also be customized so that some feature characteristics are given more importance than others.

- ***Manufacturing Information:***

Manufacturing information such as tolerance, surface finish etc. that is associated with a feature can also be used. Thus two parts having the same shape but largely different tolerance requirements will not be considered as similar.

- ***Applicable to Assemblies:***

Our method utilizes the feature information obtained from a feature tree. It can be easily extended to use assembly feature information obtained from an assembly tree.

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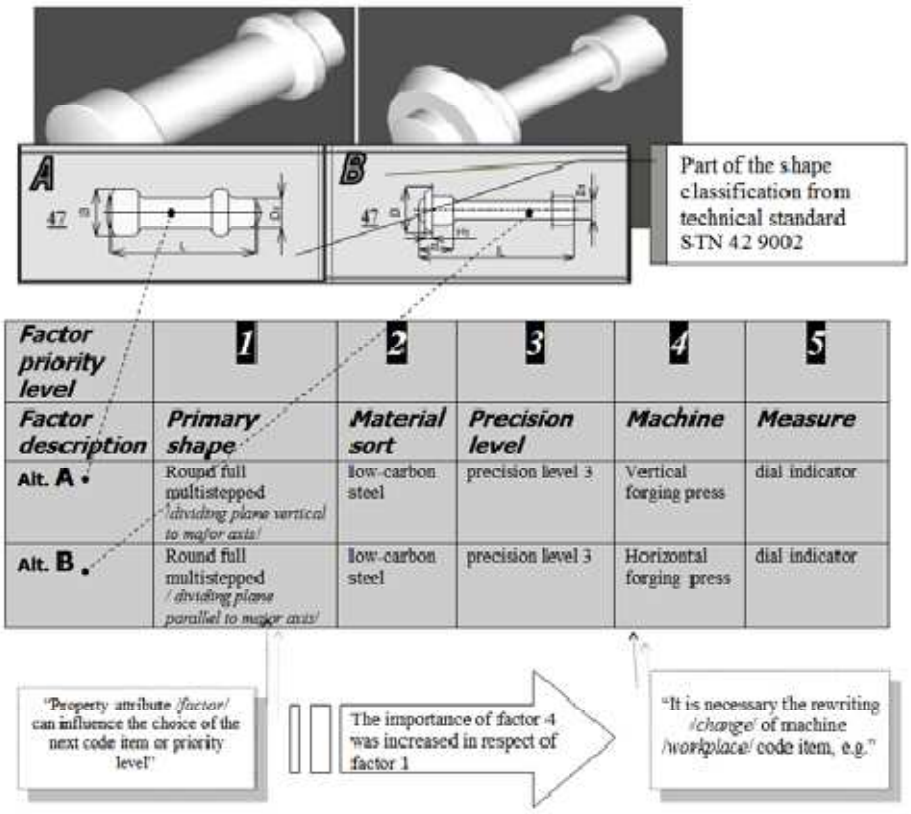

Cost Estimation for Machined Parts:

Part Family Formation:

Reduction in Part Proliferation By Reusing Previously Designed Parts:

After deriving the new product structures, product manager starts with searches of some similar product Structures in data base. When similar product is found, comparison is started. Product manager compares two structures to identify changes or differences between the two product structures in order to make further work easier. Now product manager can:

1. Identify component changes between assemblies.
2. Test for consistency between multiple views of the same item.
3. Find differences between differently configured structures.

The given example shows two product structures of mechanical roller. Product manager uses all mentioned mode levels to compare two product structures and find the differences. In the left window we can see product structure parts (components) of the old product, and in the right window is the product structure of new model of roller.

Conculsion:

A classification system that more precisely reflects flexible demand is needed. Dynamic classification has been used to categorize product properties according actual demand. During past years, the classification systems in CAPP systems have utilized static classification. The static classification system does not reflect important changes in the factory.

The disadvantages of the current CAPP systems based on GT lie in their static classification systems, which are not suitable for flexible change of GT representatives. There is no support to apply it in these systems. A new approach consists of applying methods, which enable the dynamic grouping of the engineering parts in the individual groups according to selected criterions (e.g.cost, precision, equipment, level of automation, etc.).

The dynamic classification system includes a flexible classification system that generates a detailed and comprehensive knowledge catalogues based on the actual criterions used in the input.The building of a dynamic classification system utilized in GT CAPP is a time demanding and a very labour intensive task. The task requires theoretical elaboration, the working out of a serious methodology of process planning and the used of an advanced programming technique. It seems that the dynamic classification method is a very effective and flexible method for part grouping in casting and forging process planning.

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