SOME ASPECTS OF VARIANT COMPUTER AIDED PROCESS PLANNING SYSTEMS

Przybysz, E. & Pijanowski, M.[i]

MSc. Eng. Przybysz E.[ii]*, MSc. Eng. Pijanowski M.*[iii]
[1 1] Poznań University of Technology, Faculty of Mechanical Engineering,*
3 Piotrowo street 60–965, Poznań, POLAND, e–mail: elvis@sol.poznan.pl

Abstract: The characteristics of computer aided process planning (CAPP) systems and group technology (GT) as classification and coding system, have been presented in the paper.

1. INTRODUCTION

The development of production enterprises is a complex process. Producers are continuously pressed by increasing, both domestic and international competition. Increasing of the competitiveness is connected with advanced application of the computer aided (CA) systems. Unfortunately, these systems are not widely applied in machine industry in pre-production and production phases. The basic aim of continuously developed computer aided systems is their maximal optimisation and getting them closer to the idea of process planning under conditions of concurrent engineering. On top of that, it is very important to have effective management, improving the process control, decreasing of production time as well as the total production cost.

Many companies have different process planners make different process plans for the same parts, resulting in inconsistencies and extra paper work. Computer Aided Process Planning (CAPP) systems can help in overcoming these inconsistencies. CAPP aids in creation of process plans for manufacturing and increases the flexibility of manufacturing. Process planning is a task which requires a significant amount of both time and experience. Computer support or computerised process planning systems can help reduce a process planning time and increase plan consistency and efficiency.

In the history of computer aided process planning two different ways of obtaining the process plan can be observed:

- Variant process planning,
- Generative process planning.

Two basic approaches for CAPP has been presented in Figure 1.

Variant method applies coding and classification schemes where previously prepared technological processes of the other element, is searched, and this process becomes the base of new technological documentation. Computer operator regarding to the shape and dimensions of the elements modifies technological process.

In generation method a plan of technological process is created using much more complicated methodology. Of course, sets of data concerning element description and knowledge base are necessary while generating the process. In this case, basing on the characteristic features of each element, the machining process is prepared from the very beginning. It is used for each new product. The CAPP generation systems are mainly composed of:

- graphical description of elements (CAD),
- producer's data base,
- logical taking decisions,
- various algorithms

2. GROUP TECHNOLOGY IN CAPP

The creation of part data base, accessed through Group Technology (GT) codes, results in little reinvention of the wheel, and eventually, design rationalisation and variety reduction. When a new part has to been designed, the data base is accessed to check whether such a part or similar part has been designed before. This represents in effect the institutional memory and serves to counter the adverse effects of turnover among technical personnel.

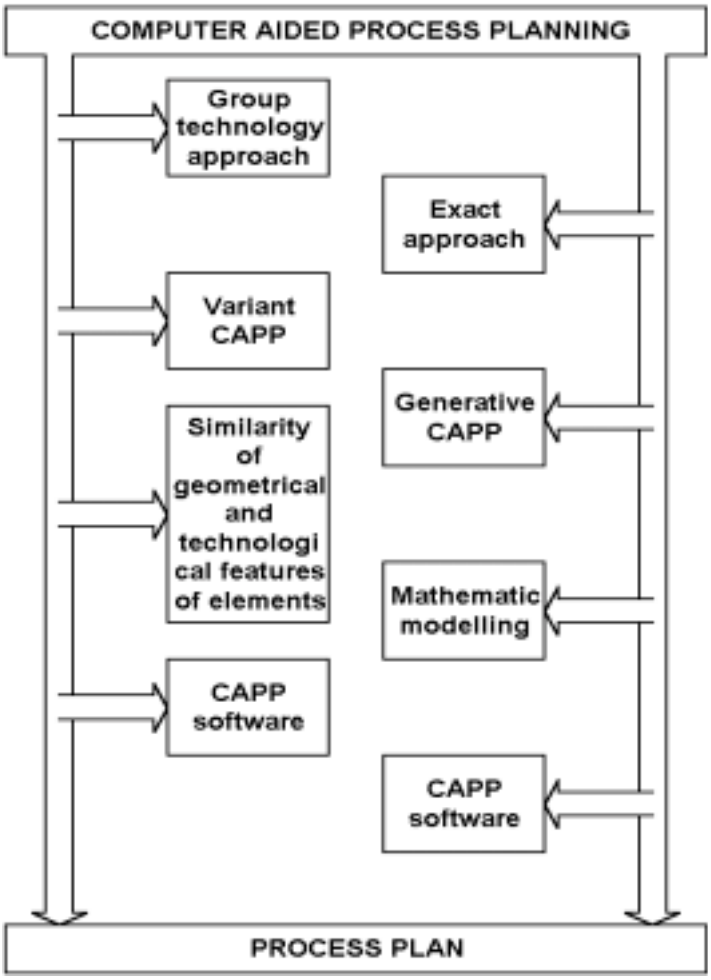

Fig. 1 Two basic approaches for CAPP [wg1]

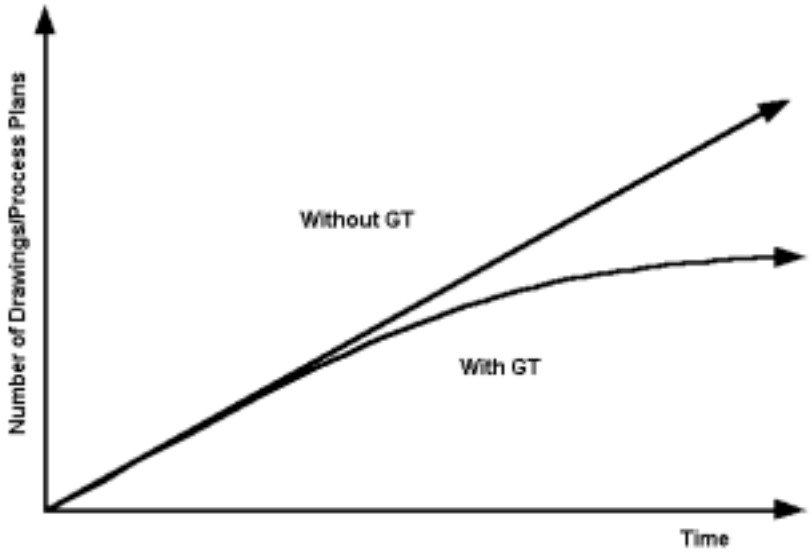

Fig. 2 Standardisation through GT in design and process planning [4]

This reliance on a part data base accessed through GT codes, also results in reduced engineering lead time, increased productivity, more reliable and maintainable designs, besides the benefits of standardisation and variety reduction. The proliferation of part drawings and process plans is countered with GT, as shown in Figure 2.

The variant CAPP approach involves, using GT code, retrieving the process plan of similar part design earlier, and making minimal modifications to it.

Here, the problem appears how to segregate elements into set families with design-technological similarity. In order to achieve this goal it is necessary to classify all the elements that have been machined or are machined in a given factory. The classification is the process of the element segregation onto groups basing on assumed rules or characteristic features. Therefore, various classification systems are applied. As the result of such action each product is marked with classification symbol, so called GT code. The structure, the composition and the capacity of these symbols vary between each other according to the assumed coding system.

Generally, there are two element classification systems: graphical and digital ones.

Graphical classification system has been applied for example in Sysklass programme. This system is based on the visual comparison by the user, geometry of new element with the representative of the family set and then with the subsets of these families and approaching closer and closer to the most suitable existing element. However, in this case there is still a threat of misinterpretation of new element features and as a result it will be classified completely wrong. The scheme of the graphical classification has been presented in Fig.3.

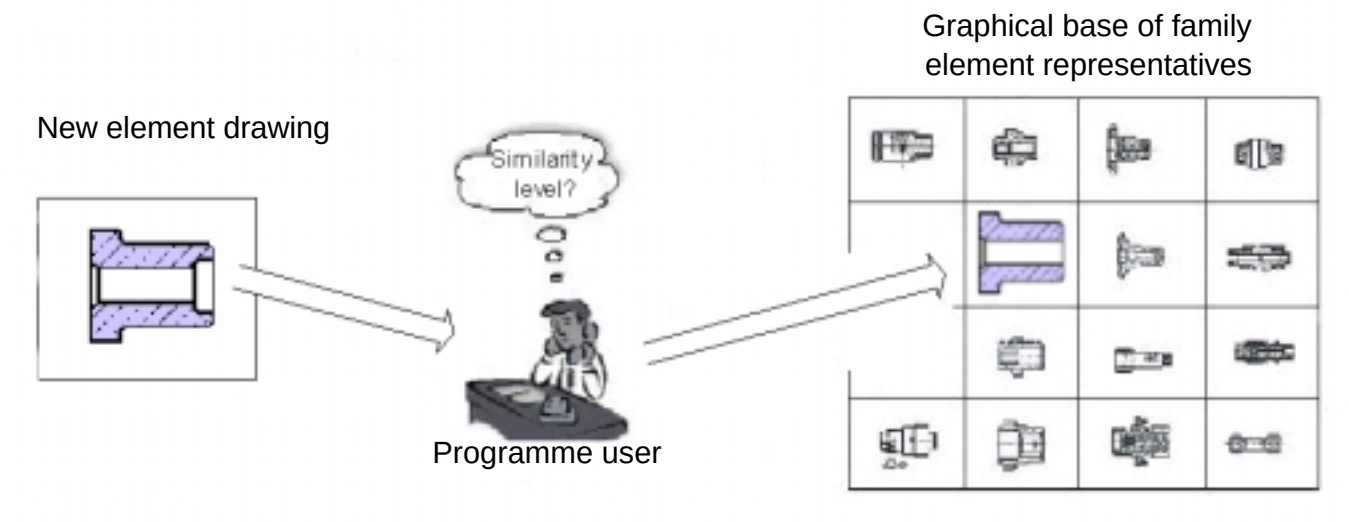

Fig.3. The principle of the graphical classification of machine elements

The other system, digital classification, is based on determination the features of new element by means of suitable key. As the result the digital-letter sequence appears and it is called as the classification symbol or the GT code. The rule concerning the determination of GT code has been presented in Fig.4.

Both described systems are widely applied in various CAD of technological processes.

3. CONCLUSIONS

Recently, there is the trend to create hybrid classification system in order to contain the maximum information about an element in the form of symbol. Such system should also enable to draw the element out of the symbol that means the drawing of the element represented by GT code in order to make visual comparison and evaluation by the operator. Moreover, proper marking of places in classification symbol could inform about existence of certain treatment or operation in the technological process of new element. Such system should also edit the existing technological process and adapting it for the element, which is just being implemented into production. Group technology is not only limited to element selection or technological process selection. It can be successfully adapted for management processes or for effective utilisation of tools, machines or equipment. It can be even used to make the working groups composed of specialised workers. Such philosophy in case of its application in machine industry can enable to improve the competitiveness of products and services.

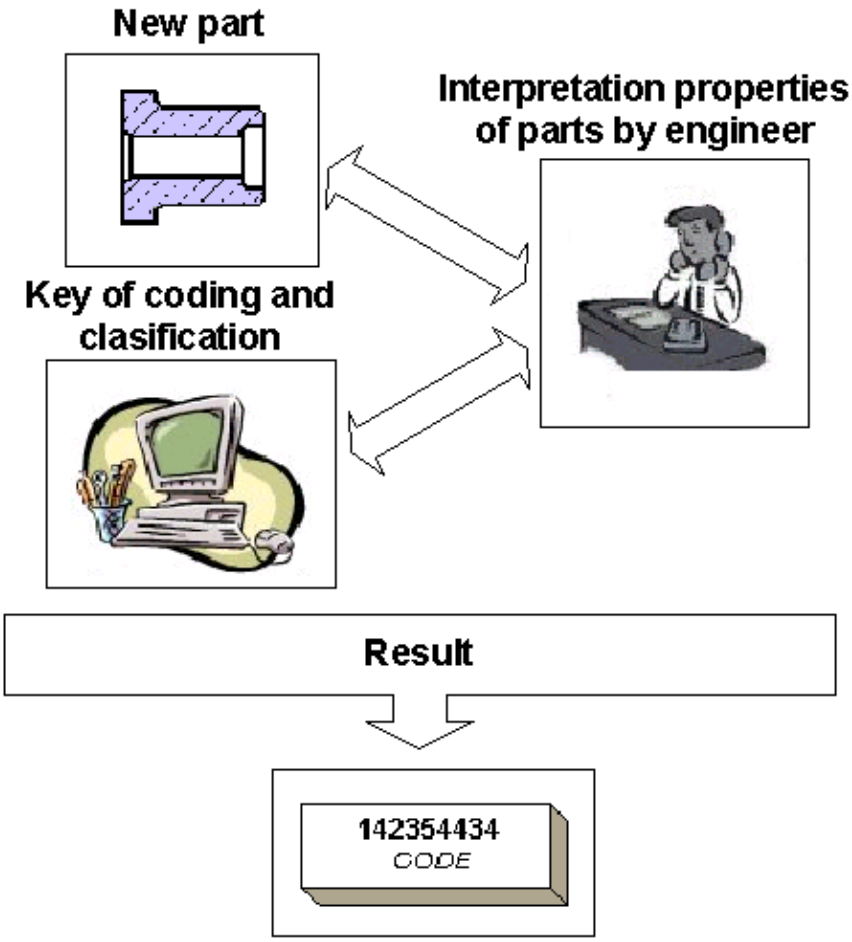

Fig.4. The principle of digital classification of machine elements

REFERENCES

[1] Kuric I., Matuszek J., Debnar R.: *Computer Aided Process Planning in machinery industry*, Bielsko – Biała 1999

[2] Przybysz E., Pijanowski M.: *Wybrane aspekty kodowania i klasyfikacji w systemach wariantowych CAPP*, Materiały konferencyjne „DOKSEM 2000" 9.11.-10.11.2000, Žilina 2000, ss. 124-129

[3] Przybysz E., Pijanowski M.: *Technologia grupowa w komputerowym wspomaganiu projektowania procesów technologicznych*, Doktorandsky seminar „Automatizácia a počitačová podpora predvýrobných etáp, výrobných a technologických procesov", 27–28.03.2001, Žilina–Súlov, ss. 102–106

[4] Suresh N.C., Kay J.M.: *Group technology and cellular manufacturing*, Massachusetts 1998, USA

[5] Demeč, P.: *Presnosť obrábacích strojov a jej matematické modelovanie*. Košice, Vienala 2001. 146 strán. ISBN 80-7099-620-X

[6] Gallová, Š. - Demeč, P.: *Computer-Aided knowledge-based system for research of machine tool working accuracy*. Science Report-Project PL-1 Geometrical Surface Structure of Machine Parts. Wydawnictvo Politechniki Świętokrzyskiej w Kielcach, Kielce 2001, str. 97-102. ISBN 83-911200-8-2

[7] Demeč, P. - Madáč, K.: *Automatizácia inžinierskych prác pri návrhu komponentov progresívnej výrobnej techniky*. Zborník vedeckých prác VŠT v Košiciach 1990, str. 381-399. Bratislava, ALFA 1990. ISBN 80-05-00618-7