

Contemporary Inclination in Capp Systems for Prismatic Parts

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ABSTRACT: *CAPP system plays a key role to integrate design and manufacturing or assembly systems properly using available resources and design constraints. So many CAPP systems have so far been developed by different researchers. They have adopted different advanced techniques and approaches such as feature or solid model based design, object oriented programming, technological databases, and utilized advanced computing methods including expert system and artificial intelligence. In this recent decade some research areas such as feature recognition or feature extraction from CAD file, application of AI techniques like Genetic Algorithms (GAs), Artificial Neural Network(ANN), Fuzzy logic are gaining more attention among the researchers. Feature recognition improves overall effectiveness of a manufacturing system by eliminating the human involvement between design and process planning. Due to the rapid development of computing technology, AI techniques have been found to be very suitable at different stages of process planning. Poor responses of the current static CAPP systems to the real time shop floor status and dynamic nature of the manufacturing environment made many researchers to develop dynamic CAPP systems. In this paper, a comprehensive overview of the current trend particularly in research works on CAPP is presented, classifying those works into several categories according to their focus without considering the ontology and architecture matters.*

Keywords: *Computer aided process planning, feature based solid modeling, computer aided design, and computer aided manufacturing.*

I. INTRODUCTION

In last ten years, many researchers have been taken place on product symmetries based process planning. Detecting symmetries in CAD models is one of the most important issues in the integration studies of CAD/CAPP/CAM in manufacturing industries. It plays a great significance from the initial to final processing phases, included manufacturing and engineering analysis. Even though many CAPP systems have so far been developed and commercialized, but there is so much vacuum being left for development of new systems advanced techniques and approaches like feature-based modeling, object oriented programming, effective graphical user interfaces, technological databases by utilizing advanced computing methods including expert system and artificial intelligence. But the enactment of CAPP systems in manufacturing, as well as process industry hold-ups. In reality, instead of development of new systems and introduction of new ideas in the field of advanced manufacturing techniques the current industries are pleased with existing systems. Nevertheless remarkable efforts have been made in developing new approaches in the CAPP systems the encouragement from industries are not contented. Computer Aided Process Planning as the main bridge between CAD and CAM.

The basic failure of the traditional approach in solving process-planning problems in a manufacturing company is to leave it in the hands of manufacturing experts. These field experts use their experience and knowledge to generate instructions for the manufacture of products based on design specifications and available facilities. Different process planners often come up with different plans for the same problem, adding inconsistency to the already complicated problem. The efficient CAPP systems provide how to convert the design specification into machine understandable form. The integration of design and manufacturing if not properly done then the process would become tailback. A high quality product, at cheapest cost is the core goal of any manufacturing industry throughout the world. The globally growing competition, complexity of parts manufacturing has been focused to non traditional approaches from end to end. Computer-Aided Planning (CAPP) systems can help reduce planning time and increase consistency and efficiency.

The manufacturing industries that uses latest CAPP systems, benefited by cost saving start from product design phase to the production planning, control and till end activities. The Computer Aided Design is the first platform in any product manufacturing environment. The CAD plays a major role in manufacturing industries. The next step in industries is how to manufacture a designed product in optimized environment considering cost and quality into account. So an excellent link is much needed to combine these two activities in

order to get specified output. Therefore, a system is obligatory to create a well-organized link between CAD-CAPP and CAPP-CAM.

An effective flow of information from design to process planning and process planning to manufacture. In order to provide flow information a basic data and knowledge is much needed for creating an effective process plan. Feedback information such as various designing features, materials, tolerance and surface quality parameters must be categorized at the design phase.

It is also necessary at earliest design phase study of man, manufacturability, functional, material, machine, process availability for particular product production. Therefore, due to this a large percentage of product cost can be reduced at minimal efforts. Dynamic and static process planning which are the key areas for research and development, will integrate design and manufacturing and reduce the total product development time by using either one way or two way interaction between design and process planning. The concept of CAPP was identified and suggested, by various eminent professionals and have been numerous research publications as well as technical surveys carried out till the date. Therefore, the trend of CAPP research has also undergone drastic changes. To the authors' knowledge, there has not been a contemporary review on the CAPP systems. Therefore, the object of this paper to provide a recent trends and knowledge review on CAPP technologies developed for machining between 2011-2013. Any CAPP system must possess the basic characteristic, [1] A CAPP system can take design data as it is and generate output that can be fed into a CAM and later a CNC system [2] A CAPP system should be extendible, adaptable and customizable for individual enterprises and to new processes. [3] Provide effective knowledge acquisition, representation and manipulation mechanisms as well as the means to check the completeness and consistency of that knowledge, [4] Involve users in some parts of the decision making process, provide heuristics as needed and supplement the system's abilities; and Come with a user-friendly interface in support of effective interaction by facilitating inputs, producing outputs and reports, and displaying the results graphically. [Xun Xu et. al]

Contemporary Inclinations of CAPP systems and technologies,

In this session various recent trends feature-based technologies, knowledge based systems, artificial neural networks, GAs, fuzzy set theory and fuzzy logic, agent-based technology, Internet-based technology, STEP-compliant CAPP and other emerging technologies have been discussed but mostly concentrated on featured based modeling. Feature technology has been playing a key role in integrating CAD and CAM. The feature has become a king because of its easy geometrical approach. However, the basic two approaches in feature modeling are 1. Feature recognition 2. Feature design the feature recognition approach inspects the topology and geometry of the component and determines the existence and dentitions of features by using entities lines, points and converts in to holes pockets. In the other word, small to higher level entities by using various approaches, like 1. Rule-based approach [RBA], 2. Expert system [ES]. 3. graph-based approach [GBA] 4. Volume decomposition approach [VDA]. The design-by-feature approach builds a part from predefined features stored in a feature library.

II. OBSERVATIONS OF CURRENT TRENDS [2011-2013]

In recent research carried out by jungfeng jiang et.al, on detecting global exact symmetries from CAD models. Therefore, a novel method has been proposed jungfeng jiang et.al, for rapid detect the global exact rotational and reflectional symmetries in feature-based CAD models by using Boolean combinations of the given features. The research can be divided in four states [1] The CAD models are classified into congruent feature sets. [2] The relationship between feature information and the symmetries of features were detected. [3] By setting feature into an ordered sequence. Finally, [4] merging and verifying of the symmetries of feature sets in the order. Finally the experimental results show that the global exact symmetries can be robustly and rapidly detected. [Junfeng.jiet, al, ElsevierLtd2013].

Mariusz Deja · Mieczyslaw S. Siemiatkowski focused on CAPP for parts manufacture in systems of definite processing capabilities, involving multi-axis machining centres by a methodical approach proposed to optimally solve for process planning problems. The method includes identification of process alternatives and sequencing adequate working steps. The approach involves the use of the branch and bound concept from the field of artificial intelligence. A conceptual scheme for generation of alternative process plans in the form of a network is developed. It is based on part design data modelling in terms of machining features. A relevant algorithm is proposed for creating such a network and searching for the optimal process plan solution from the viewpoint of its operational performance, under formulated process constraints. The feasibility of the approach

and the algorithm are illustrated by a numerical case with regard to a real application and diverse machine tools with relevant tooling. Generated process alternatives for complex machining with given systems, are studied using Models programmed in the environment of Mat lab software. [Mariusz Deja · Mieczyslaw S. Siemiatkowski, 2012]

Ali R. Yildiz, in his research, introduced a new optimization algorithm named as ‘the cuckoo search algorithm’ (CSA), the novel approaches made easy for solving manufacturing optimization problems. The first application of the Cuckoo Search to the optimization of machining parameters in the literature, in order to express the efficiency of the Cuckoo Search, a milling optimization problem was considered a solved. Finally the result was compared with existing techniques like, genetic algorithm ant colony algorithm, handbook recommendation, immune algorithm, hybrid immune algorithm, hybrid particle swarm algorithm, and feasible direction method. The results made obvious that the Cuckoo Search was an effectual and robust for the optimization of machining optimization problems for given parameters. [Ali R. Yildiz 2012]

Sankha Deb et, al aimed at developing an integrated and intelligent CAPP methodology for machined rotationally symmetrical parts. The main object concentrated on important aspects of process planning, [1] the machining operations selection [2] the set-up planning. The two basic objects are very keen manufacturing optimising techniques have been automated by introducing a new approach methodology. On the other hand a methodology has been developed to economically extract the required data from the CAD model of the given component and then feed it to the two process planning modules.

The crew too concentrated on machining operations selection, a novel back-propagation ANN methodology has also been developed by prestructuring it with prior domain knowledge in the form of thumb rules. Supplementary, an expert system based set-up planning methodology [ESBSP] has been developed for automating the tasks of set-up formation, operation sequencing and datum selection. But the total research was restricted for rotationally symmetrical parts only and not discussed about prismatic components. It has been implemented using the CLIPS rule-based expert system shell. The two process planning modules have been prefaced with a means for automatic feature recognition and extraction of CAD data from a commercial CAD software system, CATIA V5. [Sankha Deb et.2012]

Vamsi Krishna P. et, al proposed a new approach to generate process planning for Feature – Based - Modelling. Vamsi Krishna P. et, al developed a new system of approach that based on an integrated geometric modelling that supports both feature based modelling and information storage by eliminating extraction of features from already drawn parts. Due to this, as a result feature geometric and other information can be visualized to downstream activities. Vamsi Krishna P. et, al bifurcated the modules into three [1] feature based modelling module, [2] feature information storage module and [3] process planning generation module. An Auto CAD solid modelling graphical environment has been used as the core platform. Finally proved that the approach was user friendly, flexible and simple compared with existing approaches. Vamsi Krishna P. et, al suggested that this new approach can be extended for prismatic parts. [Vamsi Krishna P. et, al 2011]

III. CONCLUSIONS

In recent decade, CAPP approach continues to be used by some manufacturing companies. The feature-based approach has been adopted by many developed process-planning systems, due to its ability to facilitate the representation of various types of components data in a significant form needed to drive the computerized process planning. There are usually a number of researches and core key steps in the development of a computerized process planning systems by number of eminent researchers have been discussed. Expert systems like neural network, GA, fuzzy logic and PN all belong to artificial intelligence. Artificial intelligence plays an important role in CAPP, as it allows a process planning system to be adaptive and self-learning. The concept of CAPP was identified and suggested, by various eminent professionals and have been numerous research publications as well as technical surveys carried out till the date. Therefore, the trend of CAPP research has also undergone drastic changes. To the authors’ knowledge, there has not been a contemporary review on the CAPP systems. Therefore, the object of this paper to provide a recent trends and knowledge review on CAPP technologies developed for machining between 2011-2013.

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