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ABSTRACT

In the modern manufacturing environment, Computer Aided Process Planning (CAPP) plays a key role in the development of Computer Integrated Manufacturing (CIM) since it acts as a link between design and manufacturing.

Majority of the existing CAPP systems deal only with specific operations like Turning, Milling, Grinding etc. A very essential requirement of the manufacturing industries in the present day is to have a broad based CAPP system providing all such provisions on a single platform. Moreover, majority of the CAPP systems extract features & dimensional details from the user interactively, which is a tedious task. This method has a tendency to introduce some amount error due to the user’s misinterpretation of the drawing.

The focus of the present work has been to extract the geometric data and combine it with the validated technological data to develop the product data with minimum user interaction. It’s a fact that, in the present manufacturing industries most of the product data is being stored in CAD models. Hence, the CAPP system must have some mechanism to extract the product feature information from the CAD models.

In the perspective of all the above arguments, the present thesis attempts to provide a CAPP system in various modules, encompassing few of the machining operations of a general machine shop. An Integrated, Intelligent and Feature based approach; deriving benefits from the Generative method has been used. Given a component,
depending on the features (identified by the Feature Extraction & Recognition module) and based on the process capabilities, the operations to be carried out are listed; the details of each operation in it are generated based on theoretical rules, database or practical constraints. Commonly used machining processes viz. Turning, Milling, Drilling and Grinding have been developed in different modules, wherein the process planning can be done for the components, with features requiring these operations. All the modules have been designed to support most of the common manufacturing features including the Prismatic, Cylindrical, Interacting/Combination and Complex cavity types.

The input to the system is the 3D Solid models developed in CAD software in the form of a neutral format namely STEP. STEP constitutes the Product Data which consists of Geometric and Technological data. The purpose of STEP development has been to build a common standard that ensures the product data can be communicated electronically across different platforms, e.g. CAD, CAM and CAPP.

STEP enables all individuals contributing to the design, manufacturing, marketing and supply of a product and its components to contribute to, to access and to share information. STEP aims at eliminating the concept of “islands of automation”.

However, the current commercial STEP versions found in commonly available CAD modelers have AP’s (AP203), which do not support storage/transfer of Technological data.
The innovative part of the present work is that, an attempt has been made to develop a new variant of STEP file which contains both geometric and technological data in it. This new variant has been named "STEP +" file.

The validated Technological data such as machine tools available, tooling, cost information, surface finish, tolerances etc. has been fed into the system by the Product Expert module. Optimum and balanced cutting parameters are highlighted to the user by using standard and commonly accepted production rules from data stored in database. Database of cutting parameters, machine tools, process capabilities etc. have been kept ready for reference whenever necessary. All the above mentioned modules, functionality, logic and Database (DB) form the Intelligent System for Manufacturing Information (ISMI).

The output from ISMI includes Feature data, Process sequence (based on process capabilities), Process Plan, CNC Part program, Cost estimate and Marketing data.

Scheduling of processes has also been attempted in the present work by developing a simple module which takes realistic data input from ISMI and schedules the operations with minimum user interaction, thereby ensuring proper capacity utilization of shop floor.

In general, a CAPP system based on fundamentals coupled with latest concepts, developed on a logical approach has been attempted to suit general medium scale manufacturing units.

Keywords: CAPP, Feature extraction, Product data, STEP.