Computer Aided Process Planning

Dr. Pulak M. Pandey

http://paniit.iitd.ac.in/~pmpandey
Computer Aided Process Planning (CAPP)

.....Process planning with the aid of computer

- Process planning is concerned with the preparation of route sheets that list the sequence of operations and work centers require to produce the product and its components.
- Manufacturing firms try to automate the task of process planning using CAPP systems due to many limitations of manual process planning. These includes:
  - Tied to personal experience
  - and knowledge of planner of production facilities, equipment, their capabilities, process and tooling. This results in inconsistent plans.
  - Manual process planning is time consuming and slow.
  - Slow in responding to changes in product design and production.
- The experience of manufacturing of different engineers, who are likely to retire, can be made available in future by CAPP.
- CAPP is usually considered to be part of CAM, however this results CAM as stand alone system.
- Synergy of CAM can be achieved by integrating it with CAD system and CAPP acts as a connection between the two.
- Readymade CAPP systems are available today to prepare route sheets.
Synergy results in when CAM is integrated with CAD to form CAD/CAM systems than a stand alone CAD or CAM systems. In such a system CAPP becomes a direct connection between design and manufacturing.
Benefits derived from CAPP

• Process rationalization and standardization
• Increased productivity of process planners
• Reduced lead time for process planning
• Improved legibility
• Incorporation of other application programs
Design approaches of CAPP systems

Retrieval CAPP systems/ Variant CAPP

- This has evolved out of the traditional manual process planning method. A process plan for a new part is created by identifying and retrieving an existing plan for a similar part, followed by the necessary modifications to adapt it to the new part.

- It is based on GT principles, i.e., part classification and coding. These coding allow the CAPP system to select a baseline process plan for the part family and accomplish about 90% of the planning work. The planner adds the remaining 10% of the planning by modifying the baseline plan.

- If the code of the part does not match with the codes stored in the database, a new process plan must be generated manually and then entered into database to create a new baseline process plan for future use.

Advantages and limitations of Variant CAPP

- Investment in hardware and software is not much.
- The system offers a shorter development time and lower manpower consumption to develop process plan.
- The system is very reliable and reasonable in real production environments for small and medium size companies.
- Quality of process plan depends on knowledge and background of process planner.
Generative CAPP

- Process plans are generated by means of decision logics, formulas, algorithms, and geometry based data that are built or fed as input to the system.

- Format of input
  - Text input (interactive)
  - Graphical input (from CAD models)

- First key: to develop decision rules appropriate for the part to be processed. These rules are specified using decision trees, logical statements, such as if-then-else, or artificial intelligence approaches with object oriented programming.

- Second key: Finding out the data related to part to drive the planning. Simple forms of generative CAPP systems may be driven by GT codes.
• A pure generative system can produce a complete process plan from part classification and other design data which does not require any further modification or manual interaction.

• In generating such plans, initial state of the part (stock) must be defined in order to reach the final state i.e., finished part.

• Forward or backward planning can be done.

• Forward and backward planning apparently appear to be similar but they effect programming significantly. The requirement and the results in of a setup in forward planning are the results and requirements, respectively, of the set up in backward planning.

• Forward planning suffers from conditioning problems; the results of a setup affects the next set up.

• In backward planning, conditioning problems are eliminated because setups are selected to satisfy the initial requirements only.

• The generative CAPP has all the advantages of variant CAPP however it has an additional advantage that it is fully automatic and a up-to-date process plan is generated at each time.

• It requires major revisions if a new equipment or processing capabilities became available.

• The development of the system in the beginning is a difficult