Computer Aided Process Planning

6ME4-02: Computer Integrated Manufacturing Systems

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Learning Outcomes

- About Computer Aided process Planning (CAPP)
- Types of CAPP, merits and demerits
- Process Planning information flow
- Computer generated time standards

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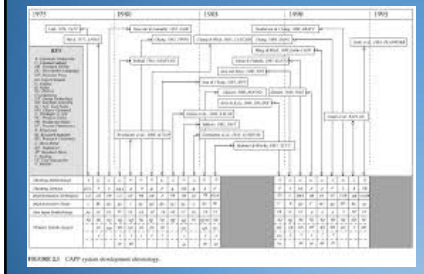
CAPP

A link between **design** and **manufacturing**

Also named as a **Route sheet**



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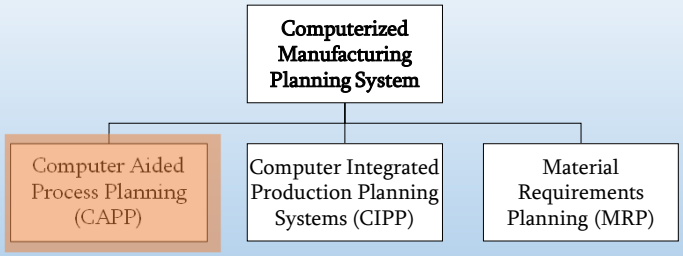
Computerized Manufacturing Planning System



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Manufacturing Engineer and Process Planning

Based on the planner's knowledge, skill and experience, the processing steps are developed in the most logical sequence.

- Interpretation of design drawing: material, dimensions, tolerance, surface finish.
- Processed sequence: Brief description of all processing steps.
- Equipment selection: To utilized existing equipments or procure new equipments. Like tools, dies, molds, fixtures, Jigs.
- Work standards: time and motion study for each operation.

⇩

Likely to be change frequently/continuously

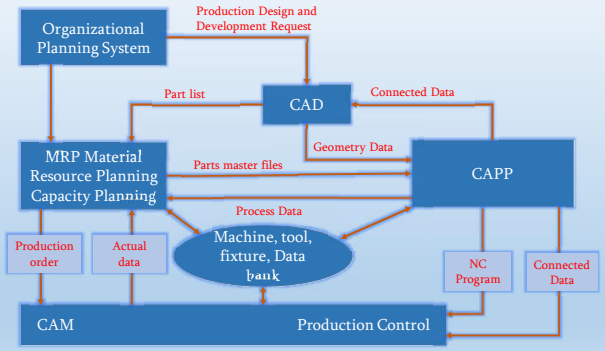
Computer Aided Process Planning: Why?

- Systematically produce product accurate and consistent process plan,
- Reduce the cost (manufacturing) and lead time,
- Reduce non-productive residence time,
- Increased productivity by utilizing idle machine tools
- Identify short material flow route
- Interfacing between cost, manufacturing lead time and work standards.
- Efficient utilization of man, machine and material/money (3Ms)

Computer Aided Process Planning

- Translation of design information into the process steps and instructions to efficient and effective manufacturing
- Helps in simplifying and efficiently carrying out the conventional process planning and optimizing used of resources.
- Detailed set of instructions, engineering drawings, specifications, parts and material list, etc.

Computer Aided Process Planning: Framework



Computer Aided Process Planning: Types or Approaches

1. Variant or Retrieval CAPP
2. Generative CAPP
3. Hybrid

- Old CAPP – New CAPP
- Design changes – Changes cost estimates
- Machine breakdown – alternate solution/effective solution

Computer Aided Process Planning: Types or Approaches

Variant or Retrieval CAPP

- Process plan for a new part is generated by recalling, identifying and retrieving an existing plan for a similar part and making necessary modification for new part
- Coding and classification schemes of group technology (GT) used, number of algorithms, mathematical models are developed for family part formation and plan retrieval

Variant or Retrieval CAPP: Advantages

- Processing and evaluation of complicated activities and managerial issues done in an efficient manner, thus reduction of time and labor requirement
- Reduced development and hardware cost and shorter development time

Variant or Retrieval CAPP: Disadvantages

- Difficult to maintain consistency during editing,
- Proper accommodation of various combinations of attributes such as material, geometry, size, precision, quality, alternate processing sequence and machine loading among many other factors are difficult,
- The quality of the final process plan largely depends on the knowledge and experience of process planner.

Computer Aided Process Planning: Types or Approaches

Generative CAPP

- Process plans are generated by means of decision logic, formulas, technology algorithms, etc.
- Main aim is to convert a part from raw material to finished state,
- Input to the system includes the description of the part in the form of part code number.

Generative CAPP

Consist of two major components:

i. Geometry based coding scheme

ii. Knowledge based coding scheme

Generative CAPP: Types

Geometry based coding scheme

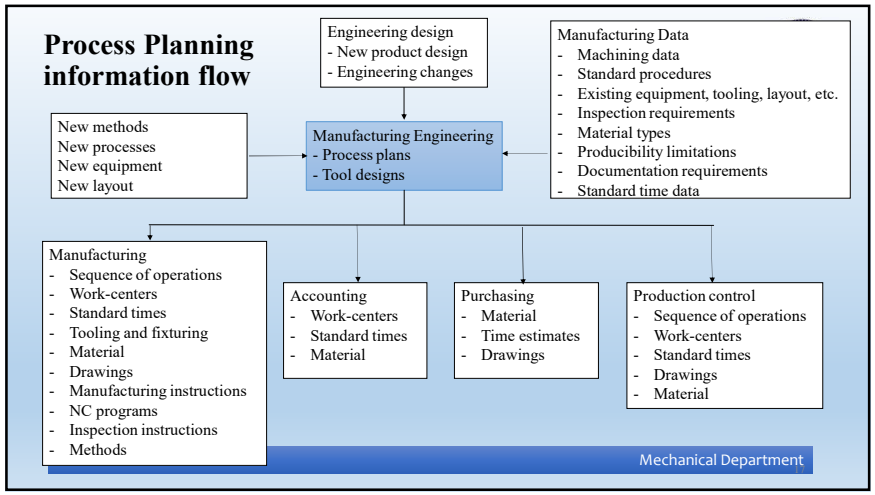
- All the geometric features for all process such as related surfaces, feature dimensions are defined by geometry based coding scheme,
- The level of detail is much greater in generative system than a variant system.

Knowledge based coding scheme

- Process knowledge in the form of decision logic and data are used for matching of part geometry requirement with the manufacturing capabilities

Generative CAPP: Advantages

- They rely less on group technology code numbers. Usually uses decision tree to categorize parts into families,
- Maintenance and updating of stored process plans are largely unnecessary,
- New components can be planned as easy as existing components.



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Computer Generated Time Standard

- **Work measurement can be defined as:**

  "a development of a time standard to indicate the value of a work task"

- **Various purposes for work measurement are:**
  - **To evaluate wage incentives**
  - **Estimating cost of a job**
  - **To schedule production and plan capacity to manufactured**
  - **To measure and estimate performance of worker**
- **Work measurement is related to process planning because:**
  - **In well-organized process planning system, a time standard must be determined for each of the operation listed on the route sheet so as to meet out the estimated order delivery schedule**

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Computer Generated Time Standard

- **Techniques usually used to estimate TIME STANDARDS**
  - **Direct time study**
  - **The use of standard data**
  - **Predetermined time standard systems**
  - **Estimates based on previous experience**
  - **Work sampling**

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Computer Generated Time Standard

- **The advantages of using a computerized system for generating time standards are:**
  - **Reduction in time required for the time study analyst to set the standards**
  - **Greater accuracy and uniformity in the time standards**
  - **Ease of maintaining the method file and standard file when engineering and method change occurs**
  - **Eliminating of controversial performance rating step**
  - **The time standards can often be set before the job gets into the production**
  - **Improved manufacturing data base for production planning, scheduling, forecasting labor requirements, tool control etc.**

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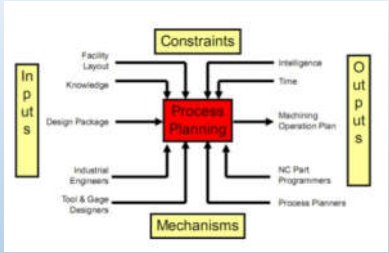
Computer Aided Process Planning

General steps involved
Design input, Material selection, Process selection, Process sequencing, Machine & Tool selection, Fixture selection, Machining parameter selection, Cost/time estimation, Plan preparation, etc.



CAPP: Overall Advantages

- It can systematically produce accurate and consistent process plans,
- It leads to the reduction of cost and lead times of process plan,
- Skill requirement of process planer are reduced to develop feasible process plan,
- Interfacing of software cost, manufacturing lead time estimation and work standards can easily be done,
- Leads to the increased productivity of process planar

Summary

- ❖CAPP: Translation of design information into the various process steps and instructions to get efficient and effective manufacturing
- ❖Based on product process plan can be retrieved from earlier plan or generate a fresh new plan or hybrid of both
- ❖Computer Generated Time Standard, its techniques and advantages

Thank you for your kind attention