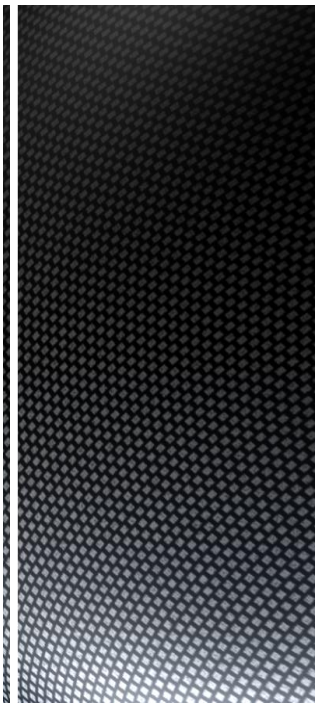
Automation (21-541)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 12



Session Schedule

- *Computer-Aided Process Planning (CAPP)*
  - *Introduction*
    - *Process planning primitives*
  - *Process planning software solutions*
    - *Architecture considerations of Process planning software solutions*

Computer-Aided Design (CAD)

- *Geometric data exchange*
  - *The heart of any CAD model is the component database.*

  This includes
  - *The graphics entities like points, lines, arcs, circles etc. and the co-ordinate points, which define the location of these entities.*
  - *This geometric data is used in all downstream applications of CAD, which include*
    - *Finite element modeling and analysis,*
    - *Process planning,*
    - *Estimation,*
    - *CNC programming,*
    - *Robot programming,*
    - *Programming of co-ordinate measuring machines,*
    - *ERP system programming and simulation.*

Computer-Aided Process planning (CAPP)

- *Process planning primitives*
  - *Process planning is concerned with determining the sequence of individual manufacturing operations needed to produce a given part or product.*
  - *The resulting operation sequence is documented on a form typically referred to as operation sheet.*
  - *The operation sheet is a listing of the production operations and associated machine tools for a work part or assembly.*
  - *Process planning is an important stage of product development since production tooling like jigs, fixtures, special tools etc. can be designed only after the process plan is finalized.*

Computer-Aided Process planning (CAPP)

- *Process planning primitives*
  - *The importance of process planning lies in the fact that process plans have a direct bearing on the cost of the part.*
  - *As new manufacturing processes and machines are introduced, process plans also undergo changes.*
  - *Process planning is a dynamic activity. The continuous emphasis on cost reduction also requires the process plans to be updated to reduce the cost.*

Computer-Aided Process planning (CAPP)

- *Process planning primitives*
  - *Process planning establishes which machining process and process parameters are to be used to convert a work material (blank) from its initial form (raw material) to a final form defined by an engineering drawing.*
  - *All the information determined by the process planning function is recorded on a sheet called process plan.*
    - *The process plan is frequently called an operation sheet, route sheet or operation planning sheet.*
  - *Process plan provides the instructions for the production of the part and contains the operation sequence, processes, process parameters and machine tools used.*

Computer-Aided Process planning (CAPP)

- *Process planning primitives*
  - *The process planning activity can be divided into the following steps:*
    - *Selection of processes and tools*
    - *Selection of machine tools/Manufacturing equipment*
    - *Sequencing the operations*
    - *Grouping of operations*
    - *Selection of work piece holding devices and datum surfaces (set ups)*
    - *Selection of inspection instruments*
    - *Determination of production tolerances*
    - *Determination of the proper cutting conditions*
    - *Determination of the cutting times and non-machining times (setting time, inspection time) for each operation*
    - *Editing the process sheets.*

Computer-Aided Process planning (CAPP)

- *Process planning primitives*

XYZ GLOBAL MANUFACTURING LTD. VELLORE 632014

PART NUMBER : 610 415 3426 **MATERIAL: FG 200**

PART NAME : PIN

Process Number	*Process Details*	*Machine*	*Tool Tip Tool holder*	*Cutting Speed m/min*	*Spindle Speed rpm*	*Feed/ Feed Rate*	*Set Up Time min*	*Process Time min*
01	HOC CC Drill	CNC LATHE						
02	Drill	CNC LATHE						
03	Face & Turn	CNC LATHE						

Homework : AT:G:09:#

- *In this HW you will try to analyze a rout sheet (shown below):*

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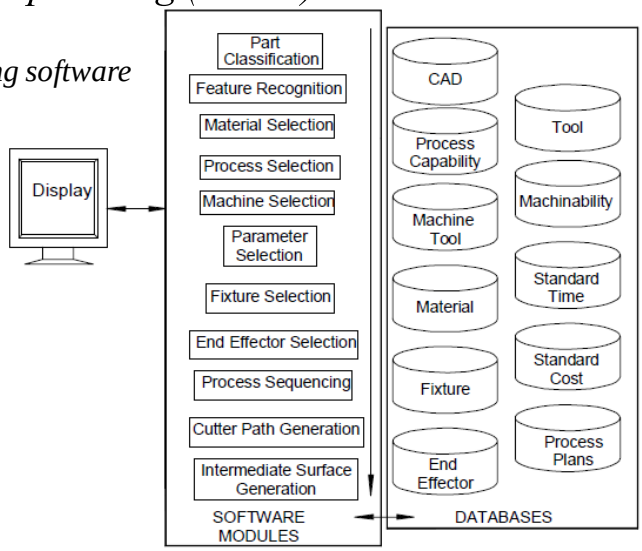
- *The HW should be sent to Fvalilai@Sharif.edu till Monday, 2nd of Dey (Dec, 23rd ,2014)*
- *Email subject: "AT:G:09:#"*

Computer-Aided Process planning (CAPP)

- *Process planning primitives*
  - *In conventional production system, a process plan is created by a process planner.*
  - *It requires a significant amount of time and expertise to determine an optimal routing for each new part design.*
  - *The process planning software provides the opportunity to generate production routings which are rational, consistent and perhaps even optimal.*
    - *Reduces the skill required of a planner.*
    - *Reduces the process planning time.*
    - *Reduces the process planning and manufacturing cost.*
    - *Creates more consistent plans.*
    - *Produces more accurate plans.*
    - *Increases productivity*

Computer-Aided Process planning (CAPP)

- *Structure of a process planning software*



Computer-Aided Process planning (CAPP)

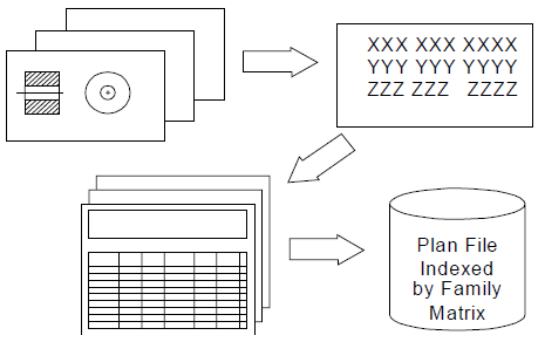
- *Process planning primitives*
  - *The current approaches for computer aided process planning can be classified into two groups:*
    - *Variant*
    - *Generative*

Computer-Aided Process planning (CAPP)

- *Variant Process planning*
  - *A variant process planning system uses the similarity among components to retrieve the existing process plans.*
  - *A process plan that can be used by a family of components is called a standard plan. A standard plan is stored permanently with a family number as its key*
  - *A family is represented by a family matrix which includes all possible members.*
  - *The variant process planning system has two operational stages:*
    - *A preparatory stage and*
    - *A production stage.*

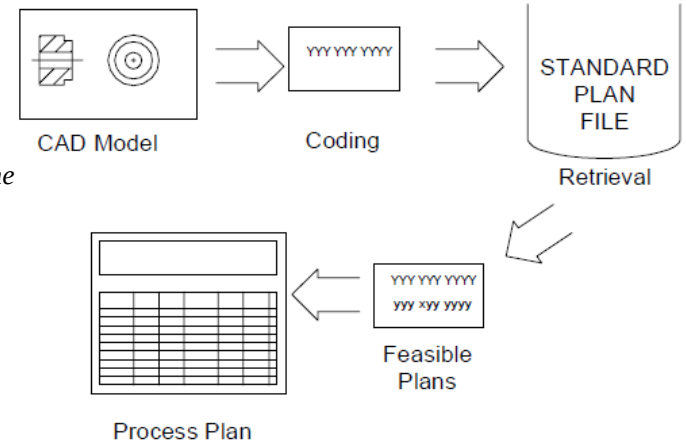
Computer-Aided Process planning (CAPP)

- *Variant Process planning*
  - *During the preparatory stage, existing components are coded, classified, and subsequently grouped into families.*
  - *The process begins by summarizing process plans already prepared for components in the family. Standard plans are then stored in a data base and indexed by family matrices*



Computer-Aided Process planning (CAPP)

- *Variant Process planning*
  - *The operation stage occurs when the system is ready for production.*
  - *An incoming part is first coded. The code is then input to a part family search routine to find the family to which the component belongs.*
  - *The family number is then used to retrieve a standard plan.*



Computer-Aided Process planning (CAPP)

- *Variant Process planning*
  - *The following are the sequences in the design of a variant process planning system:*
    - *Family formation*
    - *Data base structure design*
    - *Search algorithm development and implementation*
    - *Plan editing*
    - *Process parameter selection/updating*

Computer-Aided Process planning (CAPP)

- *Variant Process planning- Group Technology*
  - *Group technology is an operations management philosophy based on the recognition that similarities occur in the design and manufacture of discrete parts.*
  - *Similar parts can then be arranged into part families*
  - *Part classification and coding is concerned with identifying the similarities and using these similarities to evolve a classification code.*
  - *Similarities are of two types:*
    - *Design attributes (such as geometric shape and size), and*
    - *Manufacturing attributes (the sequence of processing steps required to make the part)*

Computer-Aided Process planning (CAPP)

- *Variant Process planning- Group Technology*
  - *A part family is a collection of parts which are similar either because of geometry and size or because similar processing steps are required in their manufacture.*
  - *The parts within a family are different, but their similarities are close enough to merit their identification as members of the part family.*
  - *There are three general methods for solving this problem.*
    - *Visual inspection*
    - *Production flow analysis*
    - *Parts classification and coding system*