CIM&FMS

(Module-3)

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Syllabus

Module-3 (12hours)

Introduction to manufacturing systems: Group Technology and cellular manufacturing, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology. Flexible Manufacturing system: Basics of FMS, components of FMS, FMS planning and implementation, flexibility, quantitative analysis of flexibility, application and benefits of FMS. Computer Aided Quality Control: objectives of CAQC, QC and CIM, CMM and Flexible Inspection systems.

Learning Outcomes:

Students will be able to :

1. Know about the Group Technology and Cellular Manufacturing .
2. Know about Part family , Part classification and part coding used in Manufacturing.
3. Understand about Production flow and Machine cell design.
4. Understand the fundamentals of Flexible Manufacturing System.
5. Explain about Computer Aided Quality Control.
6. Understand about Flexible Inspection System.

Group Technology and Cellular Manufacturing

- Group technology is a manufacturing philosophy in which similar parts are identified and grouped together to take advantage of their similarities in design and production.
- Similar parts are arranged into part families, where each part family possesses similar design and/or manufacturing characteristics.
- Organizing the production equipment into machine cells, where each cell specializes in the production of a part family, is called cellular manufacturing.
- There are two major tasks to perform GT:

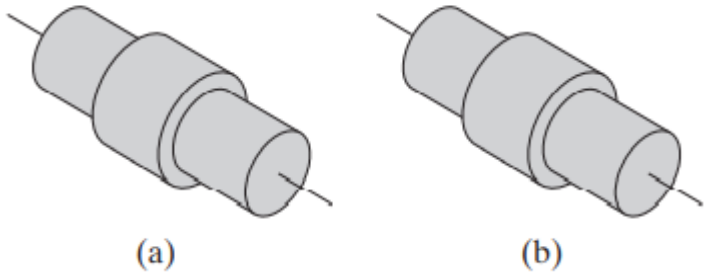
1. Identifying the part families.
2. Rearranging production machines into machine cells.

Benefit of Group Technology and Cellular Manufacturing

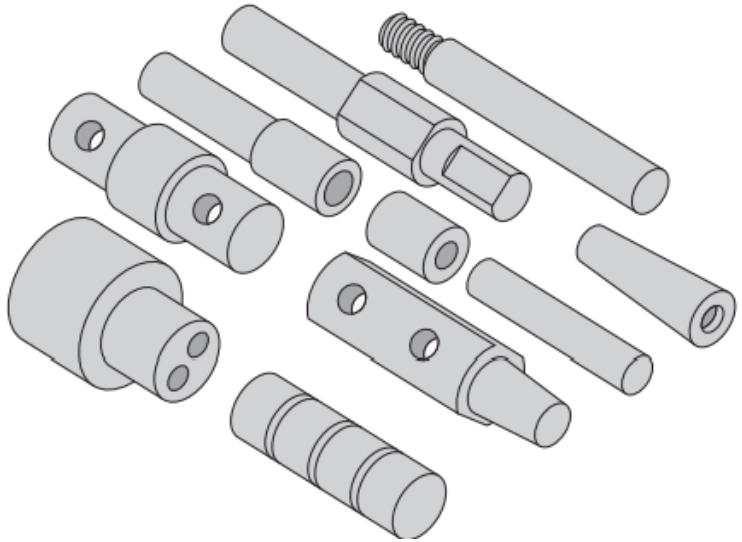
- GT promotes standardization of tooling, fixturing, and setups.
- Material handling is reduced because the distances within a machine cell are much shorter than within the entire factory.
- Process planning and production scheduling are simplified.
- Setup times are reduced, resulting in lower manufacturing lead times.
- Work-in-process is reduced.
- Worker satisfaction usually improves when workers collaborate in a GT cell.
- Higher quality work is accomplished

What is a Part Family?

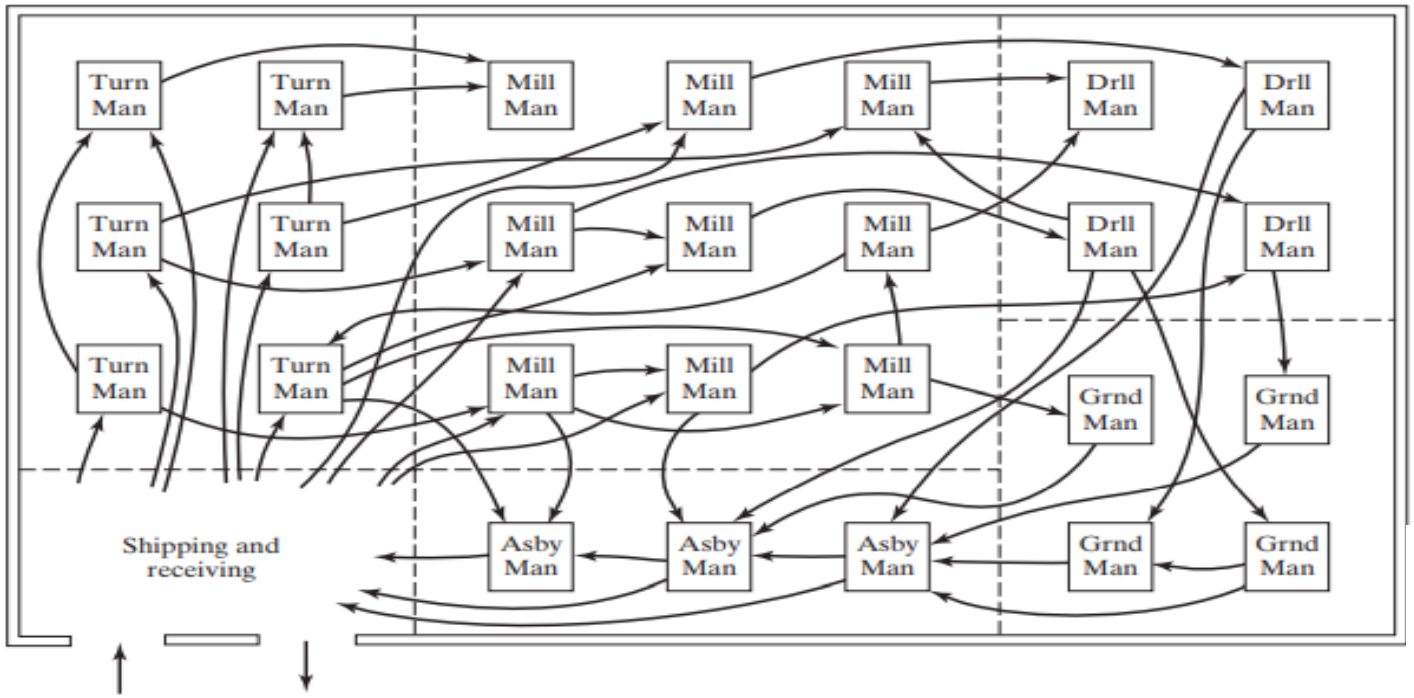
- A part family is a collection of parts that are similar either in geometric shape and size or in the processing steps required in their manufacture.
- The parts within a family are different, but their similarities are close enough to merit their inclusion as members of the part family.



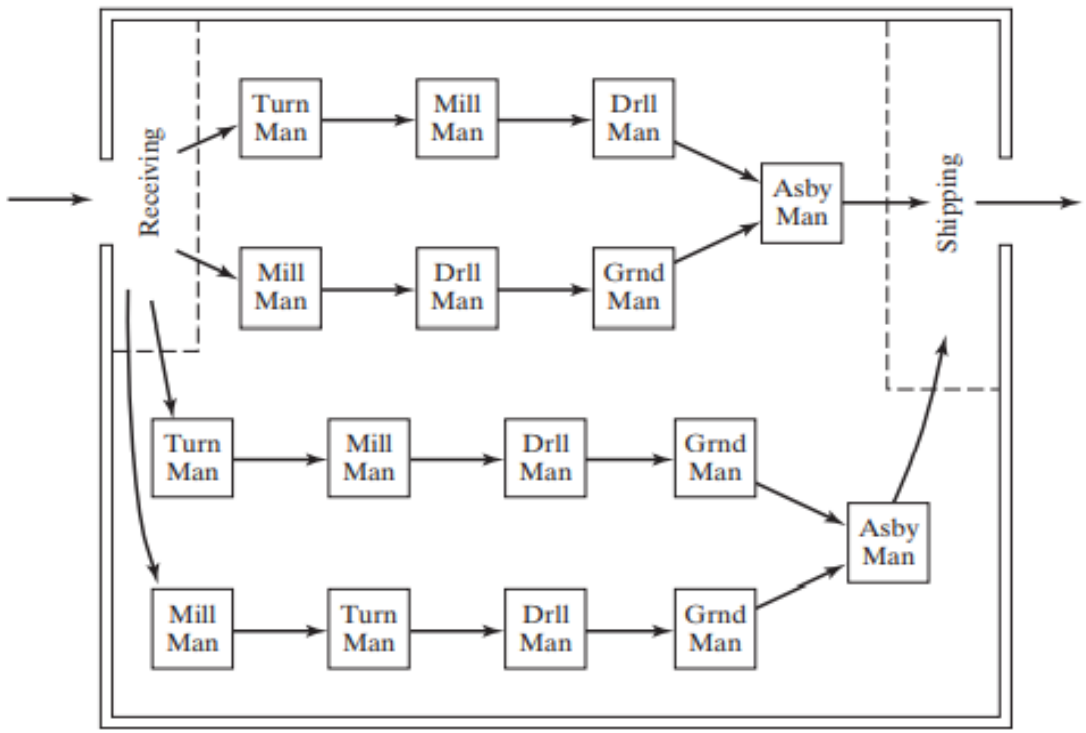
(a) 1,000,000 pc/yr, tolerance = ±0.010 in., material = 1015 CR steel
(b) 100 pc/yr, tolerance = ±0.001 in., material = 18-8 stainless steel.



All parts are machined from cylindrical stock by turning; some parts require drilling and/or milling.



Process-type plant layout



Group-technology layout

- The three methods for GT are

  (1) Intuitive grouping

  (2) Parts classification and coding

  (3) Production flow analysis

- **Intuitive Grouping**:

  This method, also known as the visual inspection method, is the least sophisticated and least expensive method. It is claimed to be the most common method that companies use to identify part families.

- Two categories of part similarities can be distinguished:

  (1) design attributes, which are concerned with part characteristics such as geometry, size, and material

  (2) manufacturing attributes, which consider the processing steps required to make a part

Design and Manufacturing Attributes in a Group Technology Classification and Coding System

Part Design Attributes	**Part Manufacturing Attributes**
Basic external shape	Major processes
Basic internal shape	Minor operations
Rotational or rectangular shape	Operation sequence
Length-to-diameter ratio (rotational parts)	Major dimension
Aspect ratio (rectangular parts)	Surface finish
Material types	Machine tool
Part function	Production cycle time
Major dimensions	Batch size
Minor dimensions	Annual production
Tolerances	Fixtures required
Surface finish	Cutting tools used in manufacture

- **Parts Classification and Coding:**

In parts classification and coding, similarities among parts are identified and these similarities are related in a coding system that usually includes both a part's design and manufacturing attributes.

- Reasons for using a coding scheme include:

1. Design retrieval
2. Automated process planning.
3. Machine cell design.

Production Flow Analysis

- It is a method for identifying part families and associated machine groupings that uses the information contained on production route sheets rather than part drawings.
- Work parts with identical or similar routings are classified into part families.
- These families can then be used to form logical machine cells in a group-technology layout.
- Procedure in PFA consists of the following steps:

1. Data collection
2. Sortation of process routings
3. PFA chart
4. Cluster analysis

Operations and/or Machines for Sortation in Production Flow Analysis (Highly Simplified)

Operation or Machine	Code
Cutoff	01
Lathe	02
Turret lathe	03
Mill	04
Drill—manual	05
NC drill	06
Grind	07

Parts (*i*)

Machines (*j*)	A	B	C	D	E	F	G	H	I
1	1			1				1	
2					1				1
3			1		1				1
4		1				1			
5	1							1	
6			1						1
7		1				1	1		

Parts (*i*)

Machines (*j*)	C	E	I	A	D	H	F	G	B
3	1	1	1						
2		1	1						
6	1		1						
1				1	1	1			
5				1		1			
7							1	1	1
4							1		1