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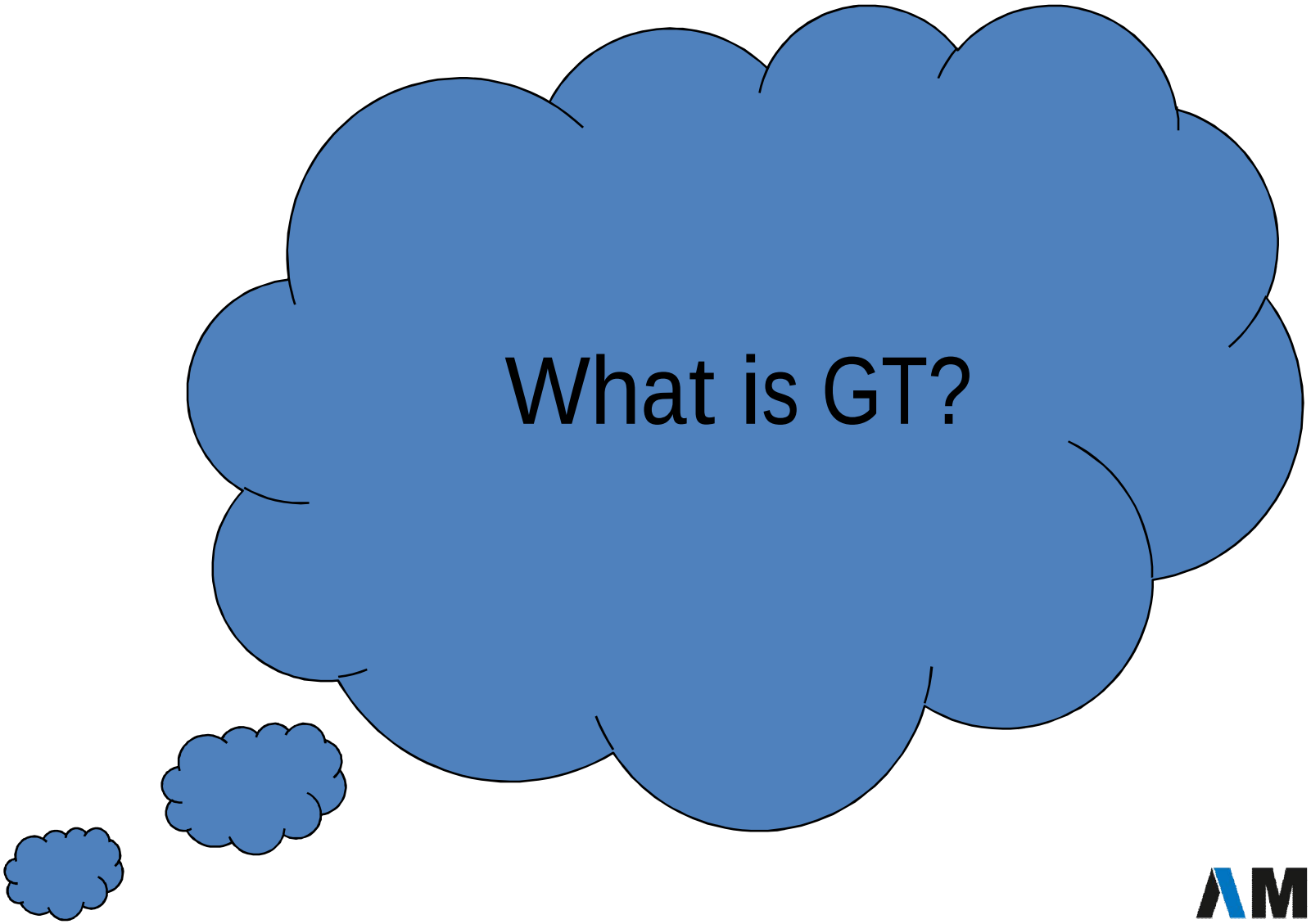
Ch-3
Group Technology

Subject:- CAM Code:-2171903	Prepared by: Asst.Prof.Harin Prajapati (Mechanical Department,ACET)	AMIRAJ COLLEGE OF ENGINEERING & TECHNOLOGY



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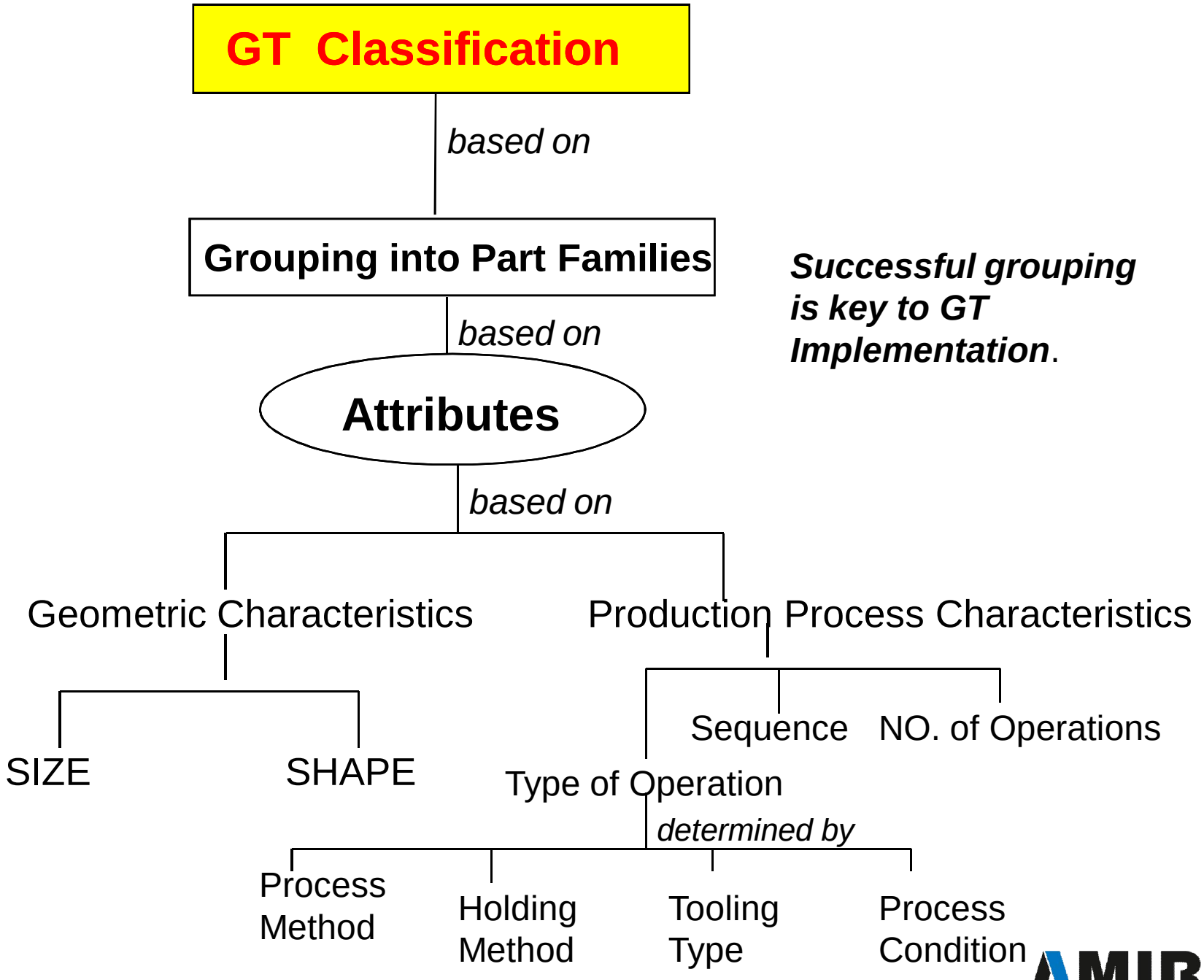
What is GT?

- GT is a manufacturing philosophy in which similar part are identified and grouped together to take advantage of their similarities in manufacturing and design.

- This group of parts or components is called part families.



Successful grouping is key to GT Implementation.

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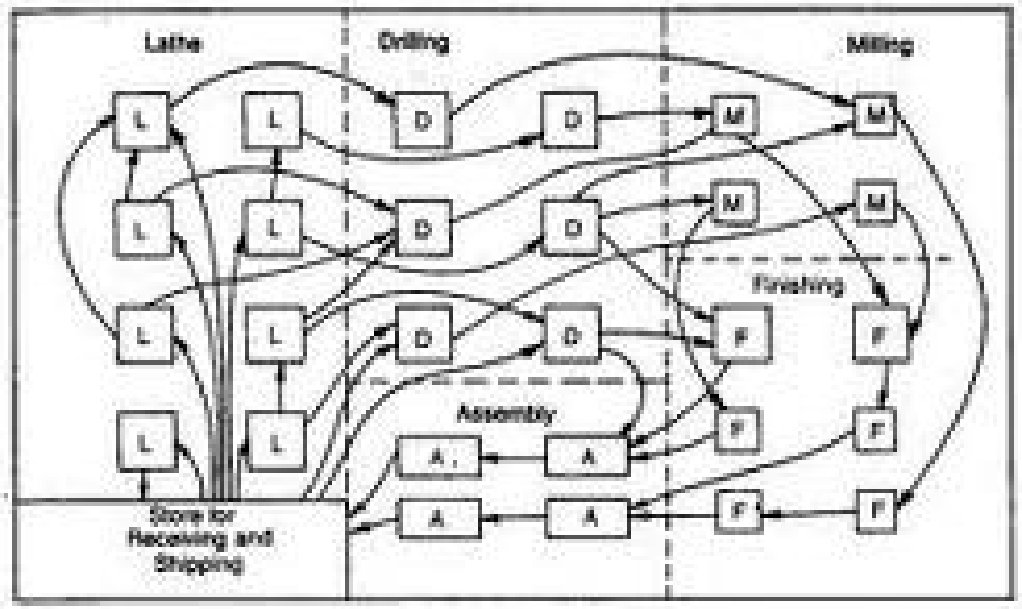
Part Families

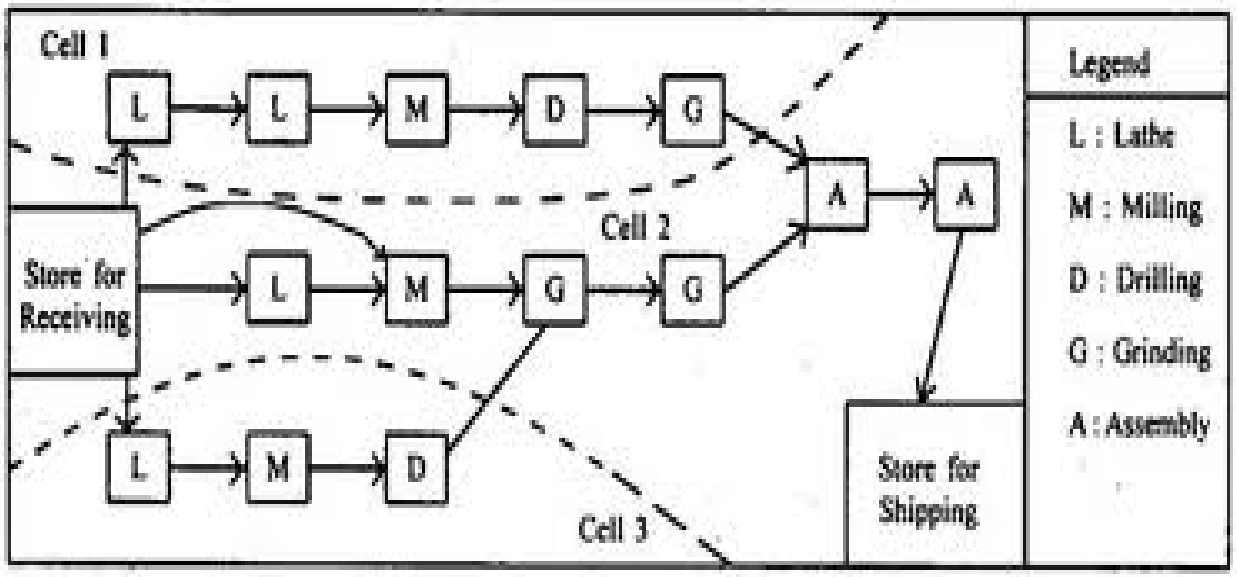
- It is a collection of part which are similar either because of geometric shape and size or because similar processing steps are required in their manufacture.

The other important features that is important choosing the families;

- Manufacturing tolerances
- Required quantities
- Materials
- Special features, which will require the use of different machine

Process type layout





GT layout

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Part Families

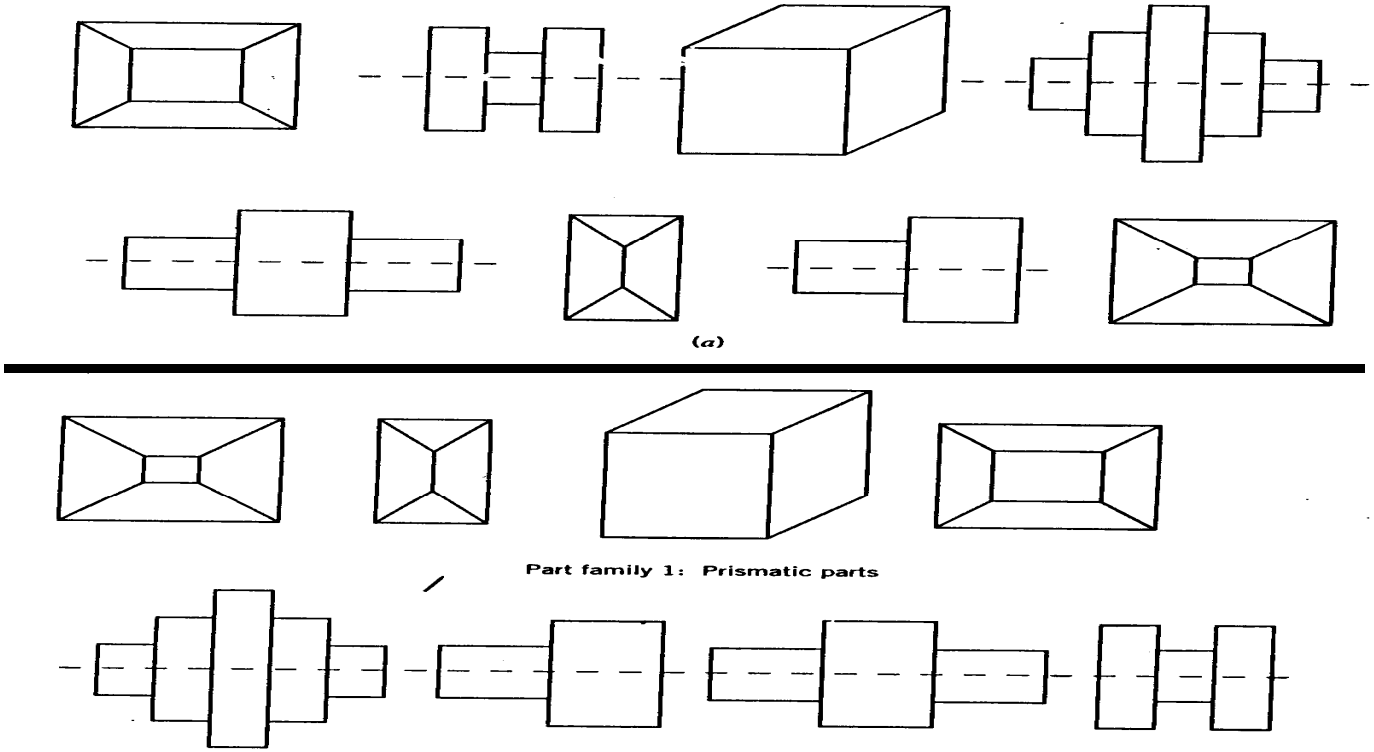
Group technology begun by grouping parts into families, based on their attributes.

There are three methods that can be used to form part families:

- **Manuel visual inspection**
- **Production flow analysis (PFA)**
- **Part Classification and coding system**

Manual visual inspection

- Involves arranging a set of parts into groups known as ***part families*** by visually inspecting the physical characteristics of the parts.



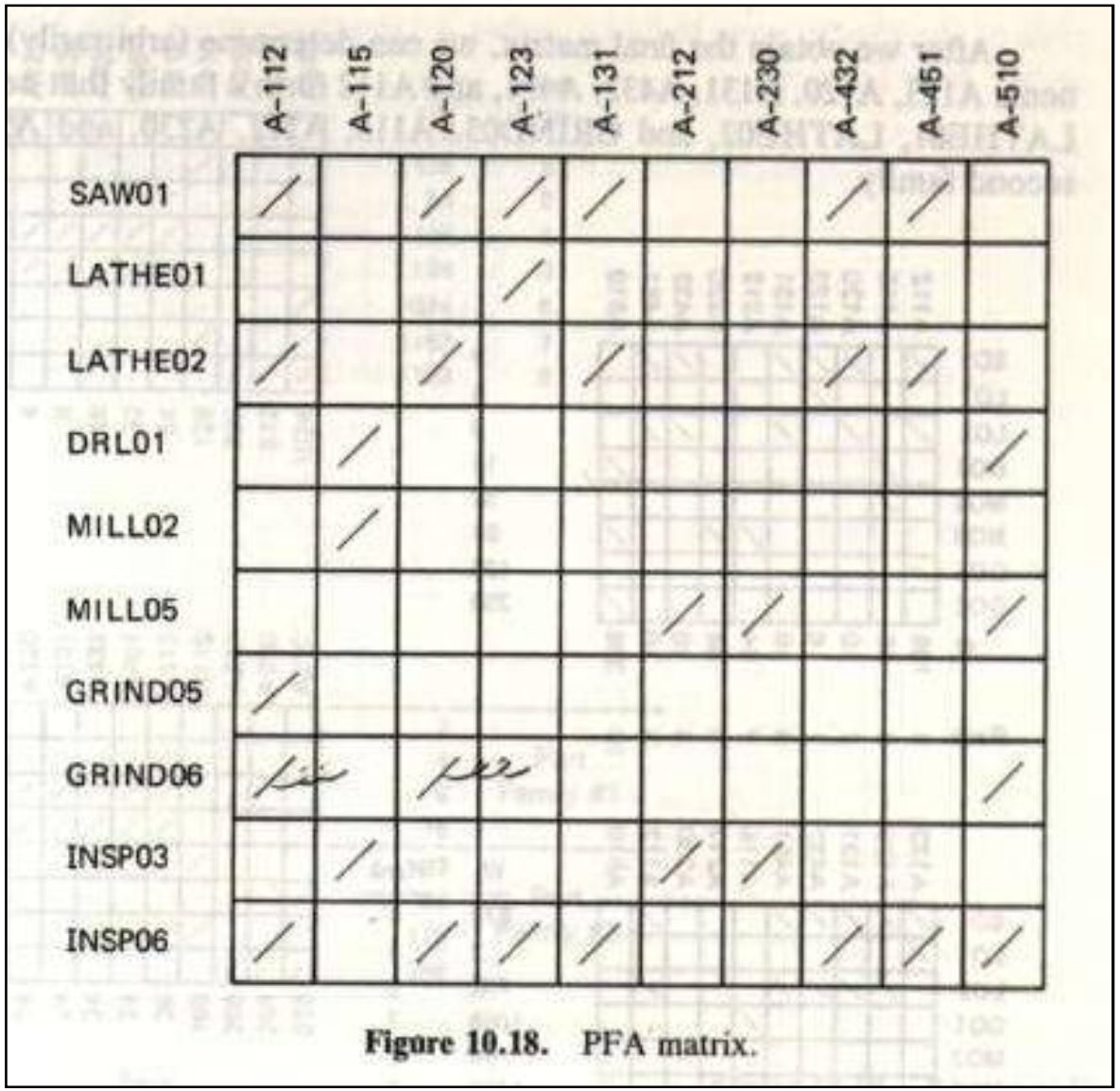
Manual visual inspection limitations

- Incorrect results
- Human error
- Different judgment by different people
- Inexpensive
- Least sophisticated
- Good for small companies having smaller number of part

Production flow analysis

- PFA is a method of identifying part families and associated machine tool grouping by analyzing the route sheets for parts produced in a given shop.
- It group together the parts that have similar operation sequences and machine routings.

Part-Family Formation



	A-112	A-115	A-120	A-123	A-131	A-212	A-230	A-432	A-451	A-510
SAW01	/		/	/	/			/	/	
LATHE01				/						
LATHE02	/		/		/			/	/	
DRL01		/								/
MILL02		/								
MILL05						/	/			/
GRIND05	/									
GRIND06	/		/							/
INSP03		/				/	/			
INSP06	/		/	/	/			/	/	/

Figure 10.18. PFA matrix.

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Parts classification and coding

- Large manufacturing system can be decomposed into smaller subsystems of part families based on similarities in part.

Part classification as per Attributes

1. Part design attributes and
2. Part manufacturing attributes
3. Both design and manufacturing attributes

Part design attributes

- Part configuration *(round or prismatic)*
- Dimensional envelope *(length to diameter ratio)*
- Surface integrity *(surface roughness, dimensional tolerances)*
- Material type
- Raw material state *(casting, forging, bar stock, etc.)*

Part manufacturing attributes

- Operations and operation sequences *(turning, milling, etc.)*
- Batch sizes
- Machine tools
- Cutting tools
- Work holding devices
- Processing times

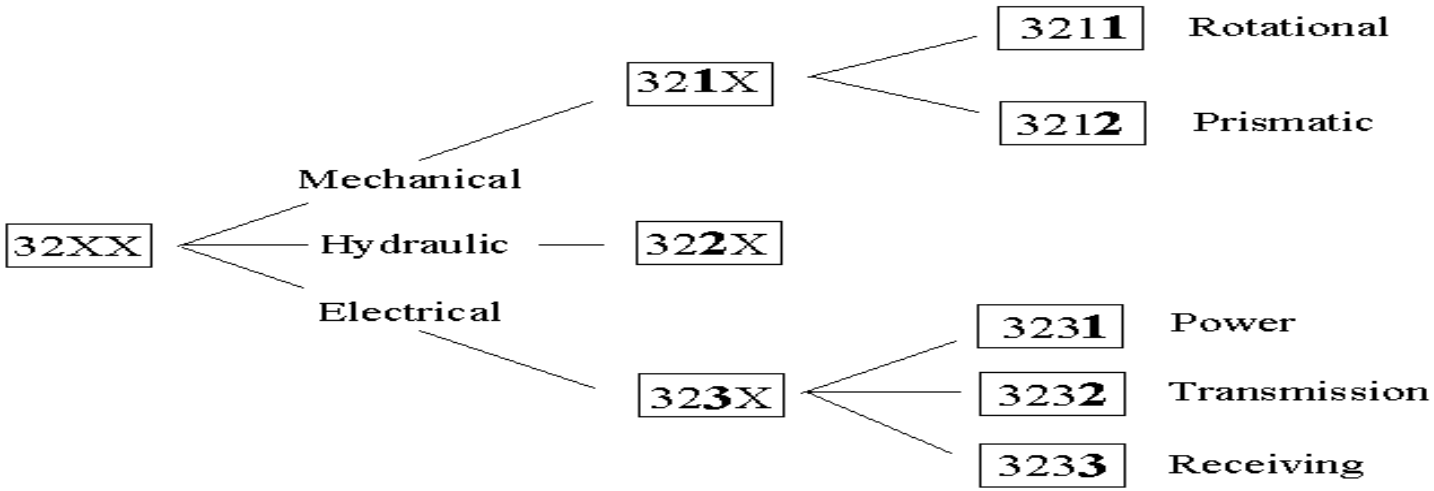
Coding methods

- Coding methods are employed in classifying parts into part families
- ***Coding*** refers to the process of assigning symbols to the parts
- The ***symbols*** represent ***design attributes*** of parts or ***manufacturing features*** of part families

- The variations in codes resulting from the way the symbols are assigned can be grouped into three distinct type of codes:
  - **Monocode or hierarchical code**
  - **Polycode or chain-type**
  - **Hybrid or mixed code**

Monocode or hierarchical code

- The structure of **monocode** is like a tree in which each symbol amplifies the information provided in the previous digit.
- It provide a relatively compact structure which give information about part in a limited no. of digits.



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Polycode (Chain-type)

- The code symbols are independent of each symbol in the sequence is fixed and not depend on the preceding digit
- Each digit in specific location of the code describes a unique property of the work piece
  - ✓ it is easy to learn and useful in manufacturing situations where the manufacturing process have to be described
  - ✓ the length of a polycode may become excessive because of its unlimited combinational features

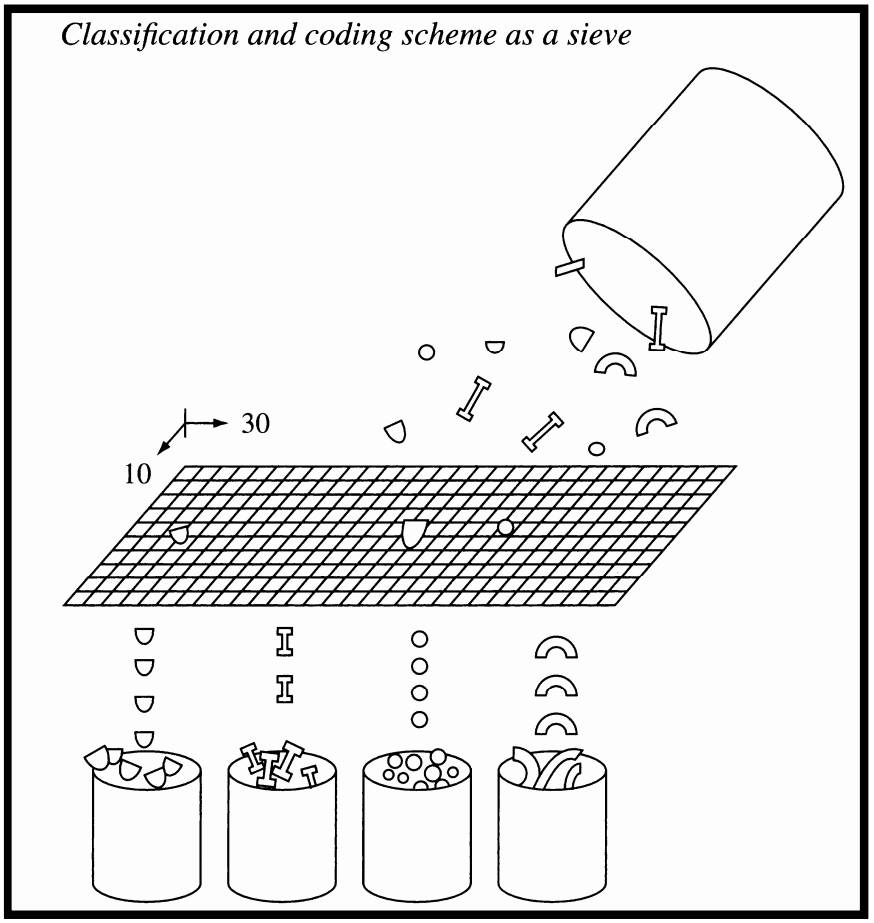
Polycode

Digit	Class of feature	Possible value of digits			
		1	2	3	4
1	External shape	Cylindrical without deviations	Cylindrical with deviations	Boxlike	• • •
2	Internal shape	None	Center hole	Brind center hole	• • •
3	Number of holes	0	1–2	3–5	• • •
4	Type of holes	Axial	Cross	Axial cross	• • •
5	Gear teeth	Worm	Internal spur	External spur	• • •
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•

MIXED CODE (HYBRID CODE)

- It is the mixture of both **monocode** and **polycode** systems. Mixed code retains the advantages of both systems. Most coding systems use this code structure.
- A code created by this manner would be relatively more compact than a pure attribute code while retaining the ability to easily identify parts with specific characteristics.

Parts Classification and Coding Systems



- Part classification and coding systems which are widely recognized among people familiar with GT:

1. **OPTIZ system**
2. **MICLASS system**
3. **CODE system**

The OPITZ classification system

- It is a **mixed** (hybrid) coding system
- Developed by **Opitz**, Technical University of Aachen, 1970
- It is widely used in industry
- It provides a basic framework for understanding the classification and coding process
- It can be applied to machined parts, non-machined parts (both formed and cast) and purchased parts
- It considers both **design** and **manufacturing** information

The Opitz coding system consists of three groups of digits:

Form code 12345	**Supplementary code 6789**	**Secondary code ABCD**
part geometry and features relevant to part design	*information relevant to manufacturing (polycode)*	*Production processes and production sequences*

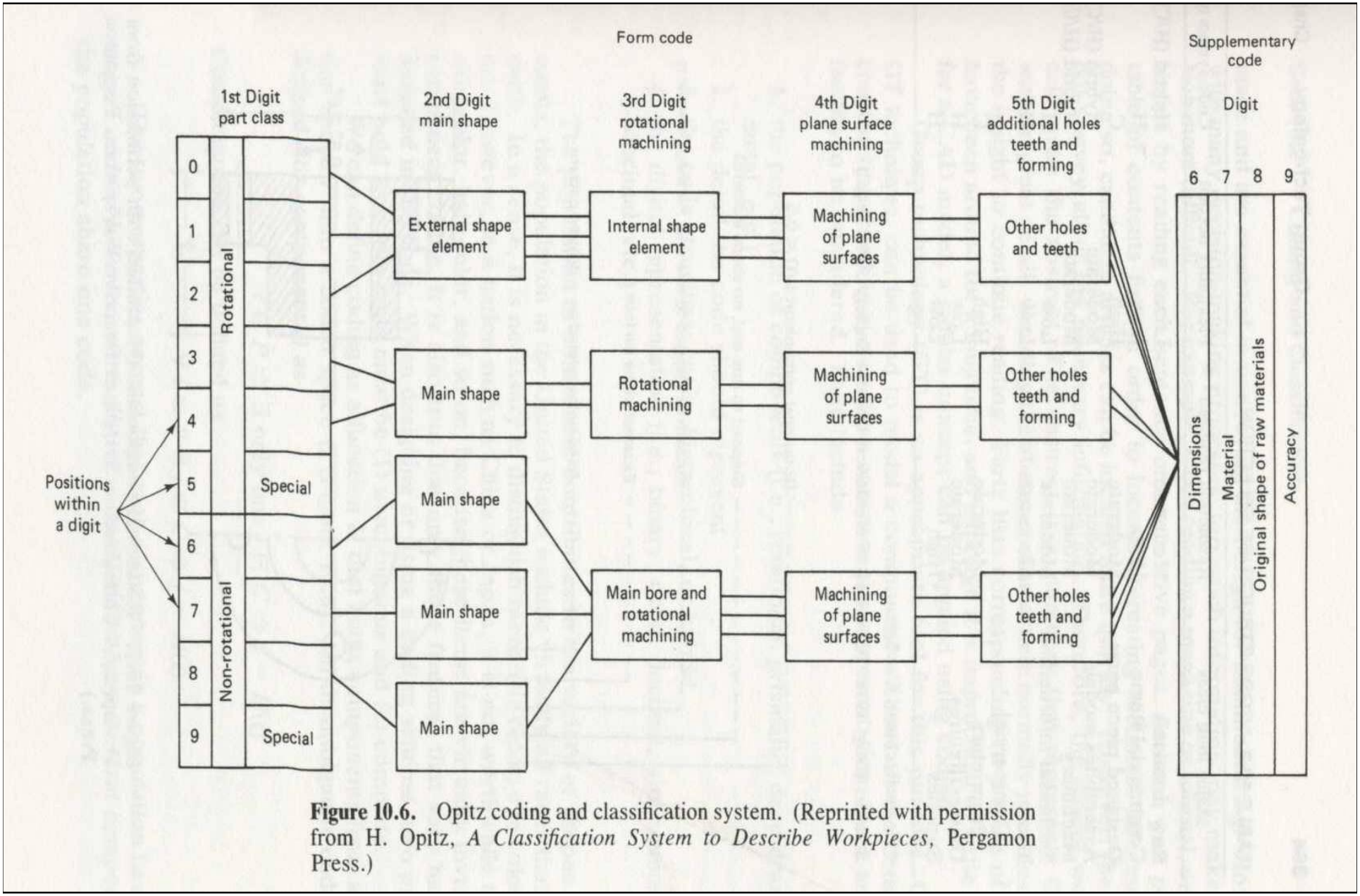


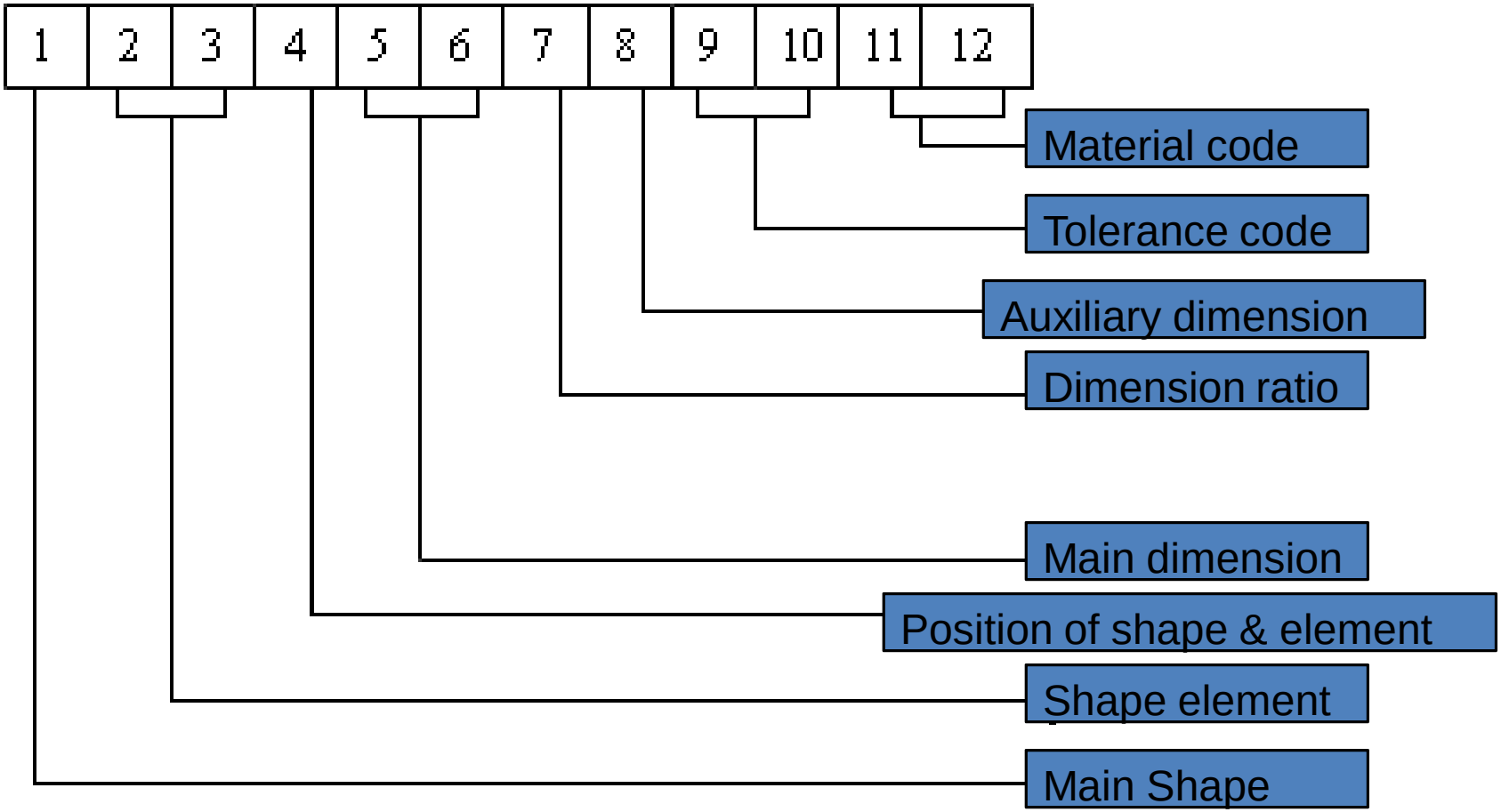
Figure 10.6. Optiz coding and classification system. (Reprinted with permission from H. Opitz, *A Classification System to Describe Workpieces*, Pergamon Press.)

Optiz Coding and Classification System

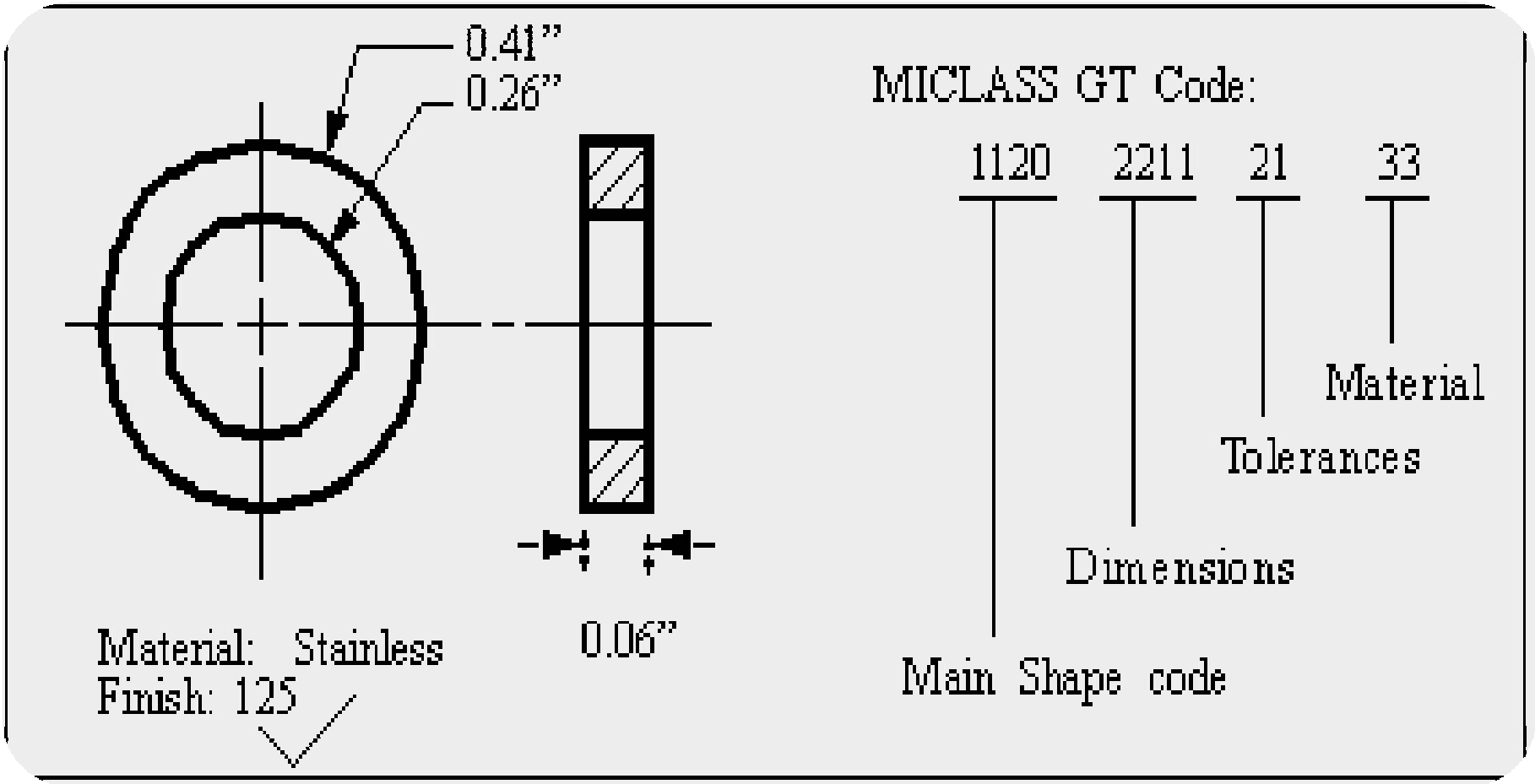
MICLASS System

- MICLASS = Metal Institute Classification System
- Consists of two major sections (segments)
- First segment is mandatory-total of 12 digits
- First 4 digits describe main shape and their elements
- Second 4 digits describe dimensions ...

MICLASS System



MICLASS System



The KK-3 System

- It was originally developed by the Japan Society for Promotion of Machining Industry. The domain is machining and grinding parts

Digit	Items	(Rotational Components)	
1	Parts name	General classification	
2		Detailed classification	
3	Materials	General classification	
4		Detailed classification	
5	Chief Dimensions	Length	
6		Diameter	
7	Primary Shapes and ratio of major dimensions		
8	Shape details and kinds of processes	External surface	External primary shape
9			Concentric screw threaded parts
10			Functional cut-off parts
11			Extraordinary shaped parts
12			Forming
13			Cylindrical surfaces
14		Internal surface	Internal primary shape
15			Internal curved surface
16			Internal flat / cylindrical surface
17		End surface	
18		Non-concentric holes	Regularly located holes
19			Special holes
20		Non-cutting processes	
21	Accuracy		

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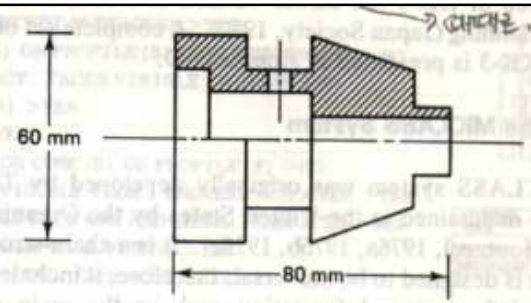
The KK-3 System



Code digit	Item	Component condition	Code
1	Name	Control valve	0
2		(others)	9
3	Material	Copper bar	7
4			
5	Dimension length	80 mm	2
6	Dimension diameter	60 mm	2
7	Primary shape and ratio of chief dimension	L/D 1.3	2
8	External surface	With functional tapered surface	3
9	Concentric screw	None	0
10	Functional cutoff	None	0
11	Extraordinary shaped	None	0
12	Forming	None	0
13	Cylindrical surface ≥ 3	None	0
14	Internal primary	Piercing hole with dia. variation, NO cutoff	2
15	Internal curved surface	None	0
16	Internal flat surface	None	0
17	End surface	Flat	0
18	Regularly located hole	Holes located on circumferential line	3
19	Special hole	None	0
20	Noncutting process	None	0
21	Accuracy	Grinding process on external surface	4

Figure 10.9. Example of a KK-3 coding system.

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COAD System

- The CODE system is a part classification and coding system developed and marketed by **Manufacturing Data System(MDSI).**
- The CODE number has eight digits.
- For each digit there are 16 possible values which are used to describe the part's design and manufacturing characteristics.
- [1]-basic geometry of part (Major Deviation of CODE).

  [2&3]- information about manufacturing process.

  [4,5&6]-specify secondary manufacturing process . (threads ,grooves ,slot ,etc…)

  [7&8]-indicate overall size of the part.

BENEFITS OF GROUP TECHNOLOGY

1. Engineering design

- Reduction in new parts design
- Reduction in the number of drawings through standardization
- Reduction of drafting effort in new shop drawings
- Reduction of number of similar parts, easy retrieval of similar functional parts, and identification of substitute parts

2. Layout planning

- Reduction in production floor space required
- Reduced material-handling effo

BENEFITS OF GROUP TECHNOLOGY

3. Specification of equipment, tools, jigs, and fixtures

- Standardization of equipment
- Implementation of cellular manufacturing systems
- Significant reduction in up-front costs incurred in the release of new parts for manufacture

4. Manufacturing: *process planning*

- Reduction in setup time and production time
- Alternative routing leading to improved part routing
- Reduction in number of machining operations and numerical control (NC) programming time

5. Manufacturing: *production control*

- Reduced work-in-process inventory
- Easy identification of bottlenecks
- Improved material flow and reduced warehousing costs
- Improved usage of jigs, fixtures, pallets, tools, material handling, and manufacturing equipment

BENEFITS OF GROUP TECHNOLOGY

6. Manufacturing: *quality control*

- Reduction in number of defects leading to reduced inspection effort
- Reduced scrap generation
- Better output quality

7. Purchasing

- Coding of purchased part leading to standardized rules for purchasing
- Economies in purchasing possible because of accurate knowledge of raw material requirements
- Simplified vendor evaluation procedures leading to just-in-time purchasing

8. Customer service

- Accurate and faster cost estimates
- Efficient spare parts management, leading to better customer service.

Thank You !