Group Technology (Part-3)

6ME4-02: Computer Integrated Manufacturing Systems

Tarun Kr. Aseri
Asst. Prof.
Mechanical Engineering
Engineering College, Ajmer
Barliya Circle, NH-8,
Ajmer-305025, India
Email: tarunaseri[at]ecajmer.ac.in

1

1

Outcomes

- Factors for selecting part coding and classification system
- Widely used techniques for Part coding and classification

2

Factors for selecting part coding and classification system

❖**Objective**
- **Will be used for design retrieval or part-family manufacturing or both?**

❖**Scope and application**
- **Which department will use?**
- **What is the specific requirement?**
- **What kind of information must be coded?**
- **How wide range of product must be coded?**
- **How complex are the parts, shapes, processes, tooling and so forth?**

Tarun K. Aseri *Mechanical Engineering Department*

3

Factors for selecting part coding and classification system

❖**Cost and time**
- **What are the cost of installation, training and maintenance required for parts classification and coding?**
- **Will there be any annual operating charges and how much?**
- **How much time required to install, train the staff to operate and maintain it?**
- **How long will it be before the benefits of the system are realized?**

Tarun K. Aseri *Mechanical Engineering Department*

4

Factors for Selecting Part Coding and Classification System

- **Adaptability to other system**
  - **Can the system be readily adapted to the existing computer systems and data based of the company/factory/manufacturing unit?**
  - **Can it be readily integrated with other existing company procedures such as process planning, NC programming and production scheduling?**
- **Management problems**
  - **Each member of management be informed and supportive.**
  - **Problem with the union.**
  - **Will cooperation and support from the various department involved?**

Tarun K. Aseri *Mechanical Engineering Department*

5

Part Classification and Coding Systems

OPITZ SYSTEM MICLASS SYSTEM CODE SYSTEM

6

Opitz system

- It is a mixed (hybrid) coding system
- Developed by Opitz, Technical University of Aachen, Germany
- 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
- Best known of the classification and coding scheme

7

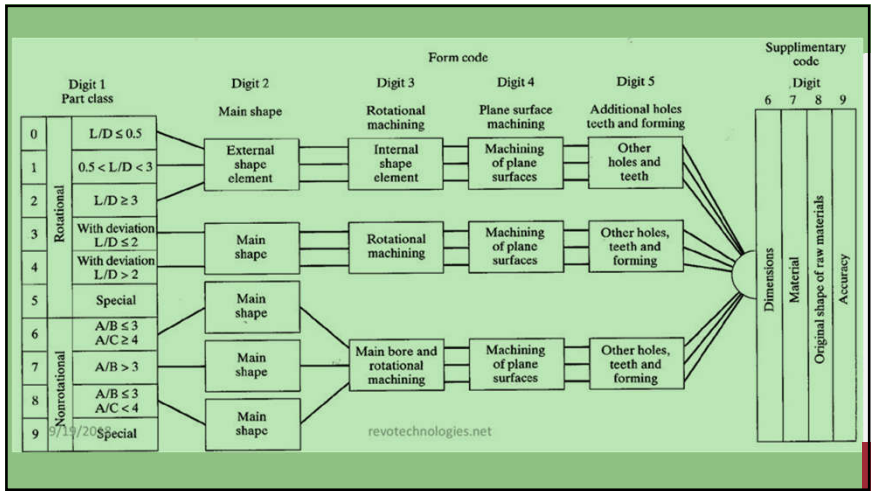
Opitz system

- **Uses the digit sequence:** 12345 6789 ABCD
- **The basic code consists of NINE digits →Extended→ by FOUR More digits**

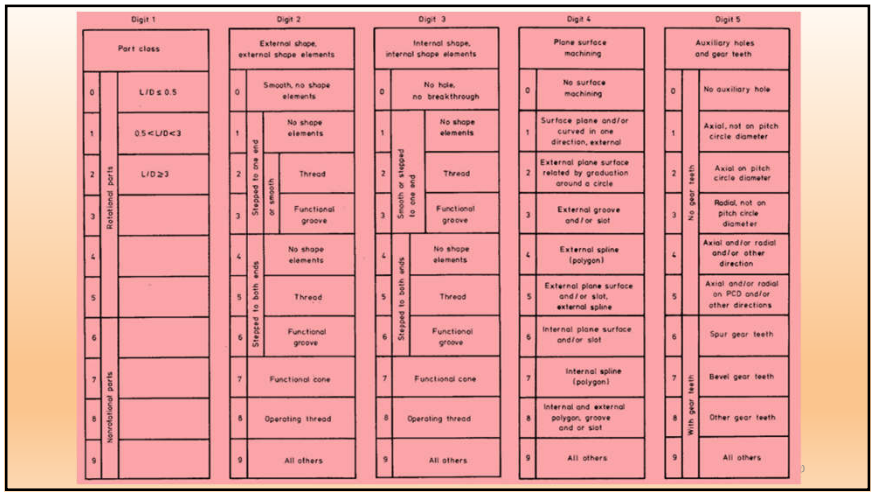
12345	6789	ABCD
Form code	Supplementary code	Secondary code
Design and Manufacturing attributes design attributes of the part	Some of the attributes used to s, work material, starting raw workpiece, shape and accuracy)	Design by Firm as per particular needs processes and sequences.

Tarun K. Aseri *Mechanical Engineering Department*

8


Form code
Supplimentary code
Digit 1
Part class
Digit 2
Main shape
Digit 3
Rotational machining
Digit 4
Plane surface machining
Digit 5
Additional holes teeth and forming
Digit
6 7 8 9
Rotational
Nonrotational
L/D ≤ 0.5
0.5 < L/D < 3
L/D ≥ 3
With deviation L/D ≤ 2
With deviation L/D > 2
Special
A/B ≤ 3 A/C ≥ 4
A/B > 3
A/B ≤ 3 A/C < 4
Special
External shape element
Main shape
Main shape
Main shape
Main shape
Internal shape element
Rotational machining
Main bore and rotational machining
Machining of plane surfaces
Machining of plane surfaces
Machining of plane surfaces
Other holes and teeth
Other holes, teeth and forming
Other holes, teeth and forming
Dimensions
Material
Original shape of raw materials
Accuracy
9/19/2022
revotechnologies.net

9


Digit 1
Part class
Digit 2
External shape, external shape elements
Digit 3
Internal shape, internal shape elements
Digit 4
Plane surface machining
Digit 5
Auxiliary holes and gear teeth
Rotational parts
Nonrotational parts
L/D ≤ 0.5
0.5 < L/D < 3
L/D ≥ 3
Smooth, no shape elements
No shape elements
Stepped to one end or smooth
Thread
Functional groove
No shape elements
Stepped to both ends
Thread
Functional groove
Functional cone
Operating thread
All others
No hole, no breakthrough
No shape elements
Smooth or stepped to one end
Thread
Functional groove
No shape elements
Stepped to both ends
Thread
Functional groove
Functional cone
Operating thread
All others
No surface machining
Surface plane and/or curved in one direction, external
External plane surface related by graduation around a circle
External groove and/or slot
External spline (polygon)
External plane surface and/or slot, external spline
Internal plane surface and/or slot
Internal spline (polygon)
Internal and external polygon, groove and/or slot
All others
No auxiliary hole
Axial, not on pitch circle diameter
Axial on pitch circle diameter
Radial, not on pitch circle diameter
Axial and/or radial and/or other direction
Axial and/or radial on PCD and/or other directions
No gear teeth
Spur gear teeth
Bevel gear teeth
Other gear teeth
All others
With gear teeth

10

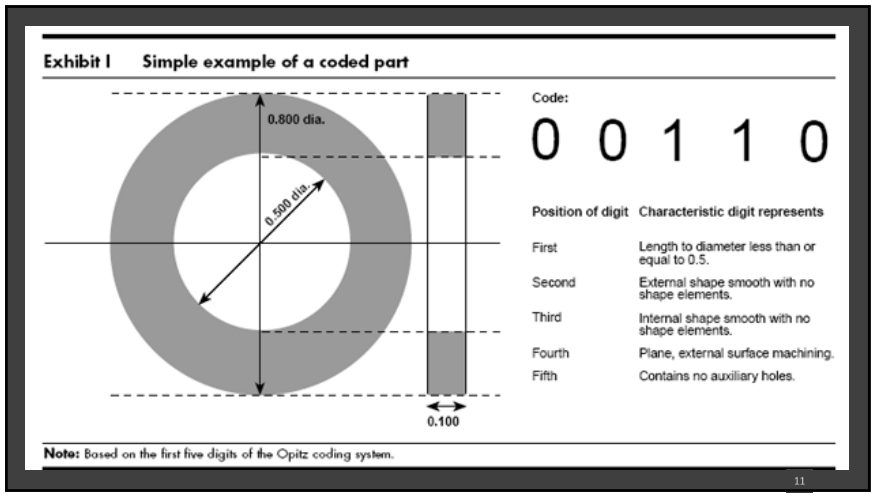
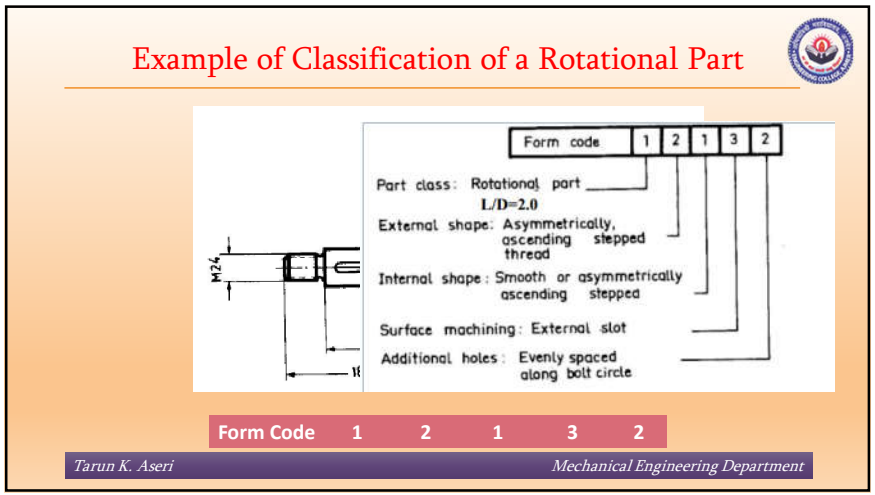


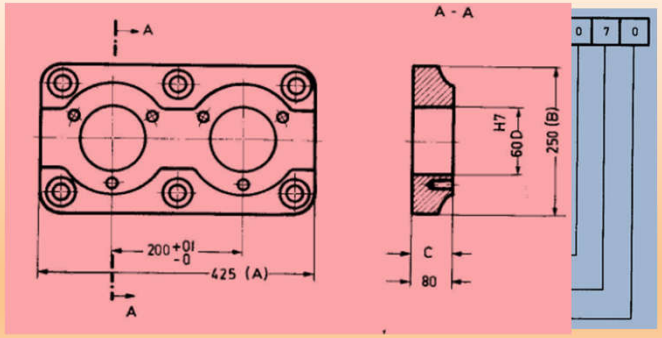
Exhibit I Simple example of a coded part
0.800 dia.
0.500 dia.
0.100
Code:
0 0 1 1 0
Position of digit
Characteristic digit represents
First
Length to diameter less than or equal to 0.5.
Second
External shape smooth with no shape elements.
Third
Internal shape smooth with no shape elements.
Fourth
Plane, external surface machining.
Fifth
Contains no auxiliary holes.
Note: Based on the first five digits of the Opitz coding system.

11


Example of Classification of a Rotational Part
Form code 1 2 1 3 2
Part class: Rotational part
L/D=2.0
External shape: Asymmetrically, ascending stepped thread
Internal shape: Smooth or asymmetrically ascending stepped
Surface machining: External slot
Additional holes: Evenly spaced along bolt circle
M24
Form Code 1 2 1 3 2
Tarun K. Aseri
Mechanical Engineering Department

12

Example of Classification of a square cast-iron flange



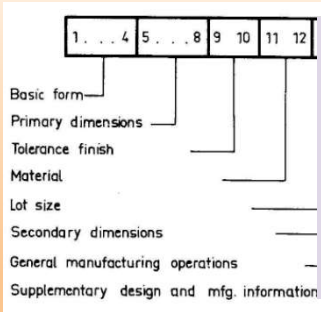
MICLASS System

- MICLASS stands for Metal Institute Classification System
- Developed by TNO, Netherland in 1969
- It help automate and standardize several design, production and management functions. These include:
  - Standardization of engineering design
  - Retrieval of drawing according to classification number
  - Automated process planning
  - Selection of parts for processing on particular group of machine tools
  - Machine tool investment analysis
- To classify a given part design, the user responds to a series of questions ask by the computer.

MICLASS System

- The work-part attributes coded in the first 12 digits of the MICLASS number are as follow:
  - 1st digit : Main shape
  - 2nd and 3rd digits : Shape elements
  - 4th digit : Position of shape elements
  - 5th and 6th digits : Main dimensions
  - 7th digit : Dimension ratio
  - 8th digit : Auxiliary dimension
  - 9th and 10th digits : Tolerance codes
  - 11th and 12th digits : Material codes
- The System consists of 30 digits (maximum)

MICLASS System

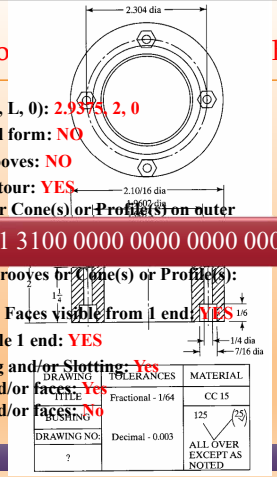


Supplementary design and mfg. information: Number of outside diameters (19), Number of inside diameters or specific shape (20), Rotational grooves or knurls (21), Close tolerance diameters (22), Splines (23), Gears (24), Sprockets (25), Pitch diameter/diameter pitch (26), Number of teeth (27)

An example o … he MICLASS system

- 3 Main dimensions (D, L, 0): 2.9375, 2, 0
- Deviation of rotational form: NO
- Concentric Spiral Grooves: NO
- Turning on Outer contour: YES
  - Special Grooves or Cone(s) or Profile(s) on outer cont…
- Turning…
  - Internal special Grooves or Cone(s) or Profile(s): NO
  - All int. dia. + Rot. Faces visible from 1 end: YES
- D1A+Rot. Faces Visible 1 end: YES
- Holding and/or Facing and/or Slotting: Yes
  - On inner form and/or faces: Yes
  - On outer form and/or faces: NO

1271 3231 3100 0000 0000 0000 0000 00



Tarun K. Aseri — Mechanical Engineering Department

17

The CODE System

- Developed by Manufacturing Data Systems Inc. Michigan, USA
- Mostly used in design engineering for retrieval of part design data, but it also has applications in manufacturing process planning, purchasing, tool design and inventory control.
- The CODE number has EIGHT digits.
- For each digit there are 16 possible values (zero through 9 and A through F)
- The initial digit position indicates the basic geometry of the part and is called the Major Division of the CODE system
- The interpretation of the remaining seven digits depends on the value of the first digit, but these remaining digits from a chain-type structure.
- Hence the CODE system possesses a hybrid structure

Tarun K. Aseri — Mechanical Engineering Department

18

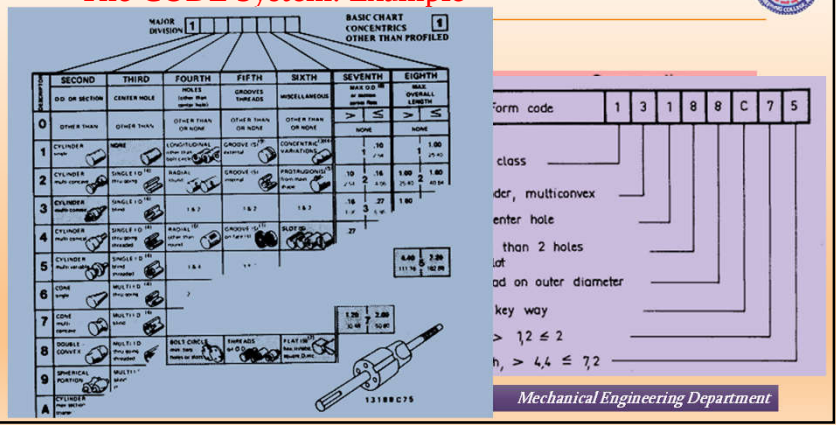
The CODE System

- The Second & Third digits → additional information
  →basic geometry and principal manufacturing process
- Digits 4, 5 and 6 → Secondary manufacturing process → threads, grooves, slots and so on.
- Digits 7 and 8 → Overall size of the part (L & D)

Tarun K. Aseri — Mechanical Engineering Department

19

The CODE System: Example



Mechanical Engineering Department

20

Other important coding system

- Brisch System developed by Brisch-Birn Inc.
- CUTPLAN developed by Metcut Associates
- DCLASS developed by Brigham Young University
- Part Analog System developed by Lovelace, Lawrence & Co. Inc.

Benefits of Group Technology

Before	After
Discontinuous, Random Flow of Parts Through the Shop	Structured Flow of Parts
Reinvent New Parts	Retrieve Parts Already in Production
Multitude of Process Plans for Some Parts	Consistent, Single, Best Process Plans
Continuous Purchase of Components due to Lack of Total Visibility	Regulated Purchase of Components
Inflexible, Rigid, Unable to Respond to Changing Environment	Flexible

Benefits of Group Technology

Product engineering -
- Reduce part proliferation
- Help design standardization
- Provide manufacturing feed back

Manufacturing engineering -
- Process selection
- Tool selection
- Machine purchases
- Material handling

Production engineering -
- Reduce lead time
- Reduce delays
- Reduce set-up time
- Improve product quality

Production planning and control -
- Group scheduling
- Stock accountability
- Reduce expediting
- Improved product design
- Reduced materials handling
- Better employee satisfaction

Benefits of Group Technology

Other benefits
- Increased productivity
- Improved accuracy in estimation of costs
- Greater standardization and variety reduction
- Reduced set up times
- Better product delivery (Helps to implement just-in-time (JIT) manufacturing)
- Reduced cost of purchasing
- Improved plant efficiency

Summary

Factors for selecting part coding and classification system,

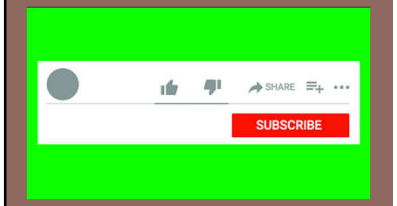
Widely used techniques for Part coding and classification:

Opitz, MICLASS and CODE system with detailed examples

Tarun K. Aseri — Mechanical Engineering Department

25

Thank you for your kind attention



26

26