IPE-432

MACHINE TOOLS SESSONAL

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Contents

1 Experiment 02: Study Milling Machine & Dividing Head (Rashik Sir)

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Why this milling machine is called "universal milling machine"?

A milling machine who has these three characteristics are counted as universal milling machine -

- The axis motion -
    1. z axis or Longitudinal motion
    2. x axis or Cross motion
    3. y axis or Vertical motion
- Sqivel Plate (make an angle for incline feed)
- Dividing Head

Why it is called knee & column type? what does it signify?

The milling machine has a knee and a column. Knee bears the weight and give support. whereas column transmit powers. That is analogous to human body, leg and spinal cord.

How many guideways? and their classifications?

There are 3 guide ways. They are -

1. Dove Tail Guide way
2. Flat or Rectangular Guide way
3. Cylindrical guide way

Dove Tail Guide Way

It looks like the tail of dove. that's why the name is given. 4 Dove tail in milling machine.

1. In between of overarm & arbor support
2. In between of table & saddle (longitudinal motion)
3. In between of saddle & knee (cross or x-directional motion)
4. In between of knee & column

Flat & Rectangular Guideway

They are normally with the stoppers. 3 flat & Rectangular guideway in milling machine.

- Stopper with table
- Stopper with Saddle
- Stopper with column

Cylindrical Guideway

Cylindrical guideway situated with arbor & arbor support.

Milling Operations

There are 3 types of milling operations in milling machine:

1. Peripheral Milling: Known as conventional milling, cut materials from the periphery
2. Face milling: cut materials with the face.
3. End milling: cut materials with cutter's teeth.

Cutting Strategies

1. Upmilling : Feed motion & cutter motion are opposite in direction
2. Downmilling : Feed motion & cutter motion in same direction

Dividing Head

Indexing

The main function of dividing head is to equally divide a circular or cylindrical object. There are 3 types of indexing.

1. Simple Indexing
2. Differential Indexing
3. Cutting Helical Gear

Name of different parts

Some parts of dividing head are - **Index Plate, Index crank, Index Crank Handle, Index Pin, Change Gear & Inside parts (such as - some spur gears, some bevel gears, 1 work gear & 1 worm wheel)**

$$\text{Required Index plate rotation} = \frac{\text{Gear ratio between index plate \& gear}}{\text{Number of gears to be cut}} = \frac{40}{T}$$

Change Gear

When number of teeth doesn't match with the index plate, then to adjust it change gear helps. For example - we want to cut 67 teeth, but nearest available index plate number is 66. So, we will choose 66 and use change gear to adjust rest. Here, we need to use **Differential Indexing** mechanism.

Helical Gear

Have to rotate workpiece also and have to sync with change gear, to cut gear inclined.

Mathematical Relations

$$p_{h.g.} = \frac{Z_o}{Z} \times 1 \times 1 \times 1 \times \frac{a}{b} \times \frac{c}{d} \times P_{l.s.}$$

$$\frac{a}{b} \times \frac{c}{d} = \frac{P_{h.g.}}{Z_o P_{l.s.}}$$

here, Z_o = No. of Teeth of worm wheel = 40
Z = No. of start of worm wheel = 1
$P_{h.g.}$ = Lead of helical gear
$P_{l.s.}$ = Lead of Lead screw
✓ worm wheel will rotate a single time, if worm gear rotates 40 times.
✓ For the above equation, right hand side is constant. So, we have to control a,b,c & d to get helical shape.
✓ It's mendatory to keep error under 1%

Set angle relation

set angle, $\omega = 90^\circ$ - Helix angle (α) = Lead angle
again,

$$\omega = \arctan\left(\frac{\pi D}{P_{h.g.}}\right)$$

✓ set angle means the angular rotation of swivel plate. helix angle means the inclination angle in helical gear.
✓ D indicates the diameter of gear blank.
✓ if we know ω, then we can find out helix angle and $P_{h.g.}$ by the above equations.
✓ For helical gear, we need to rotate lead screq by change gear.

Follow Lab sheet also.
IMPORTANT : There will be math related with this is QUIZ.