Introduction to Gears

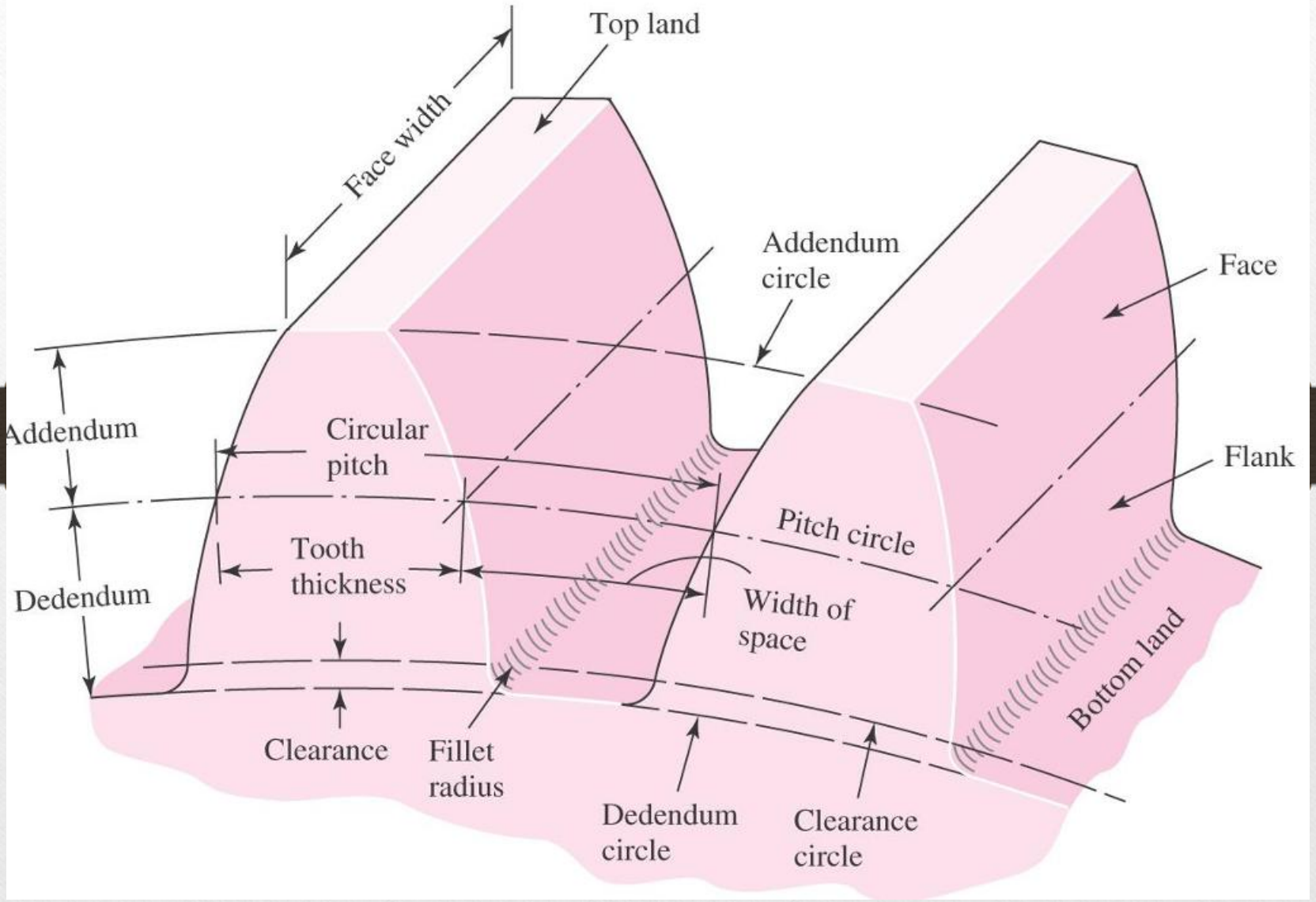
A brief overview on gears and their application in robotics

Use of Gears in Robots

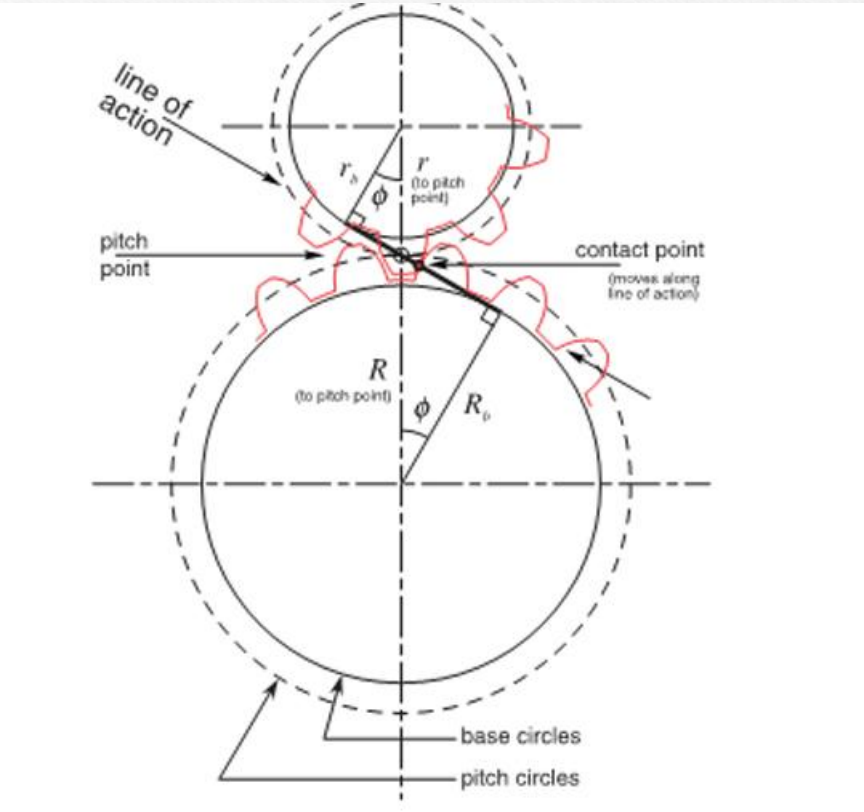
- Transmit motion and force from motors to mechanical parts.
- Amplify torque or increase speed depending on gear arrangement.
- Enable precision control of robotic arms and joints.
- Convert motor's high-speed, low-torque output to usable form.
- Constant speed ratio.

Principles of Gears

- Gears work on the principle of rotary motion transmission.
- Teeth on gears interlock to transfer torque.
- Meshing gears rotate in opposite directions.
- Conservation of energy: torque and speed can be manipulated based on gear size.


Top land
Face width
Addendum circle
Face
Addendum
Circular pitch
Flank
Pitch circle
Tooth thickness
Dedendum
Width of space
Bottom land
Clearance
Fillet radius
Dedendum circle
Clearance circle

Pressure Angle



Gear Ratio - Concept

- Gear Ratio = Number of teeth on output gear / Number of teeth on input gear.
- Gear Ratio = Rotations of driver (input) gear / Rotations of driven (output) gear.
- Affects speed and torque of rotation.
- Higher gear ratio = more torque, less speed.
- Lower gear ratio = more speed, less torque.

Gear Ratio - Examples

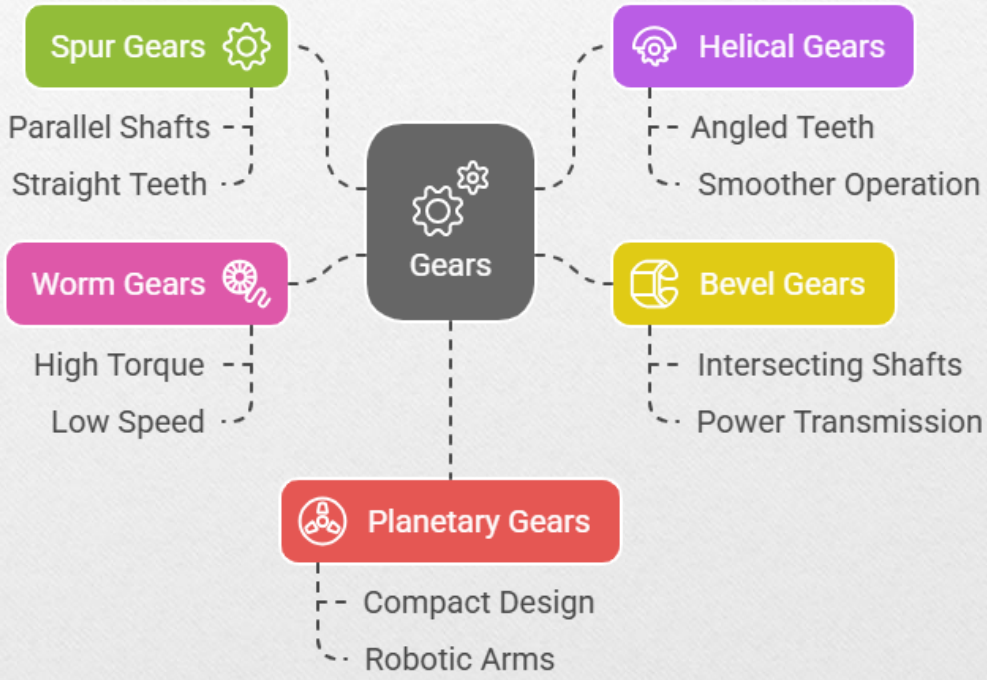
- Example 1: 10 teeth driving gear and 40 teeth driven gear

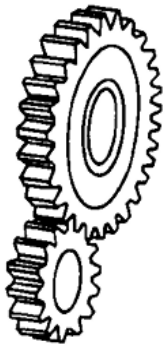
  → Gear Ratio = 40/10 = 4:1 (torque increases, speed reduces)

- Example 2: 30 teeth driving gear and 10 teeth driven gear

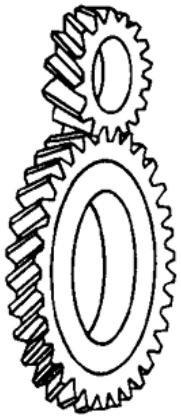
  → Gear Ratio = 10/30 = 1:3 (speed increases, torque reduces)

Types of Gears

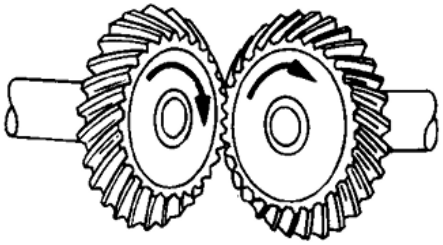




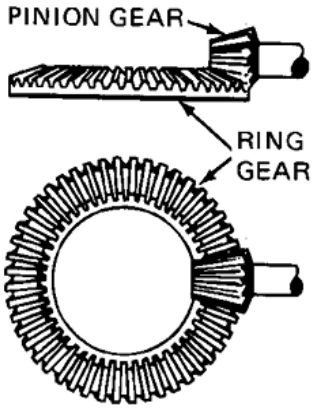
SPUR GEARS



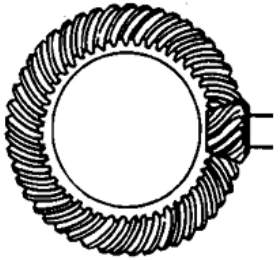
HELICAL GEARS



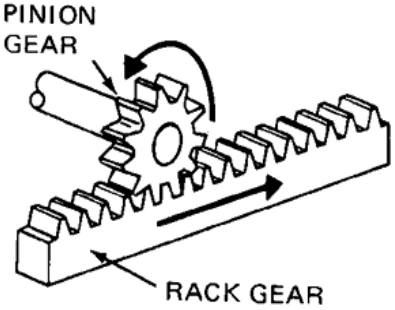
SPIRAL BEVEL GEARS



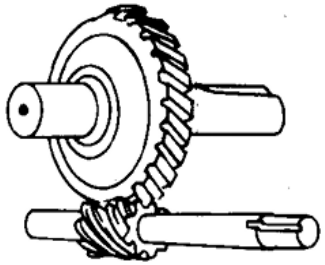
SPUR BEVEL GEARS



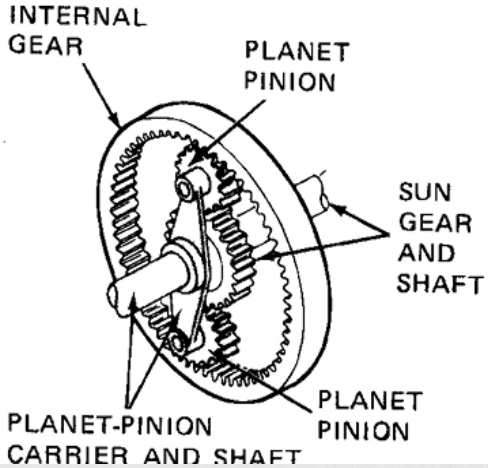
SPIRAL BEVEL GEARS

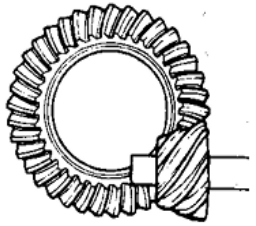


RACK-AND-PINION GEARS



WORM GEARS





HYPOID GEARS