



# Fundamentals of Gear Drives

An Online Continuing Education Course for Engineers

**Course Number: M-5018**

**Credit: 5 Hours / 5 PDH / 5 CPD**

# Fundamentals of Gear Drives

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A gear is a toothed wheel that engages another toothed mechanism to change speed or the direction of transmitted motion. Gears are generally used for one of four different reasons:

1. To increase or decrease the speed of rotation
2. To change the amount of force or torque
3. To move rotational motion to a different axis (i.e. parallel, right angles, rotating, linear etc.)
4. To reverse the direction of rotation

Gears are compact, positive-engagement, power transmission elements capable of changing the amount of force or torque. Sports cars go fast (have speed) but cannot pull any weight. Big trucks can pull heavy loads (have power), but cannot go fast. Gears cause this.

Gears are generally selected and manufactured using standards established by American Gear Manufacturers Association (AGMA) and American National Standards Institute (ANSI).

This course provides an outline of gear fundamentals and is beneficial to readers who want to acquire knowledge about mechanics of gears. The course is divided into 6 sections:

- Section -1 Gear Types, Characteristics and Applications
- Section -2 Gears Fundamentals
- Section -3 Power Transmission Fundamentals
- Section -4 Gear Trains
- Section -5 Gear Failure and Reliability Analysis
- Section -6 How to Specify and Select Gear Drives

## SECTION -1          GEAR TYPES, CHARACTERISTICS & APPLICATIONS

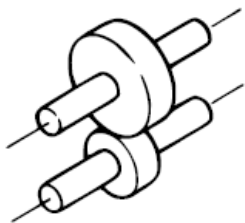
The gears can be classified according to:

1. the position of shaft axes
2. the peripheral velocity
3. the type of gears
4. the teeth position

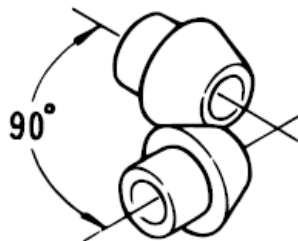
### According to the Position of Shaft Axes

Gears may be classified according to the relative position of the axes of revolution. The axes may be:

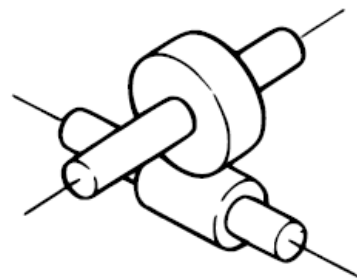
1. **Parallel** shafts where the angle between driving and driven shaft is 0 degree. Examples include spur gears, single and double helical gears.
2. **Intersecting** shafts where there is some angle between driving and driven shaft. Examples include bevel and miter gear.
3. **Non-intersecting and non-parallel** shafts where the shafts are not coplanar. Examples include the hypoid and worm gear.



**Parallel Axis**



**Intersecting Axis**



**Non Parallel  
Non Intersecting Axis**

### According to Peripheral Velocity

Gears can be classified according to the velocities.

1. **Low** velocity type, if their peripheral velocity lies in the range of 1 to 3 m/sec
2. **Medium** velocity type, if their peripheral velocity lies in the range of 3 to 15 m/sec
3. **High** velocity type, if their peripheral velocity exceeds 15 m/sec

### According to Type of Gears

According to this type, gears are external gears, internal gears and rack and pinion.

1. **External gears** mesh externally - the bigger one is called “gear” and the smaller one is called “pinion”.
2. **Internal gears** mesh internally - the larger one is called “annular” gear and the smaller one is called “pinion”.
3. **Rack and pinion type** – converts rotary to linear motion or vice versa. There is a straight line gear called “rack” on which a small rotary gear called “pinion” moves.

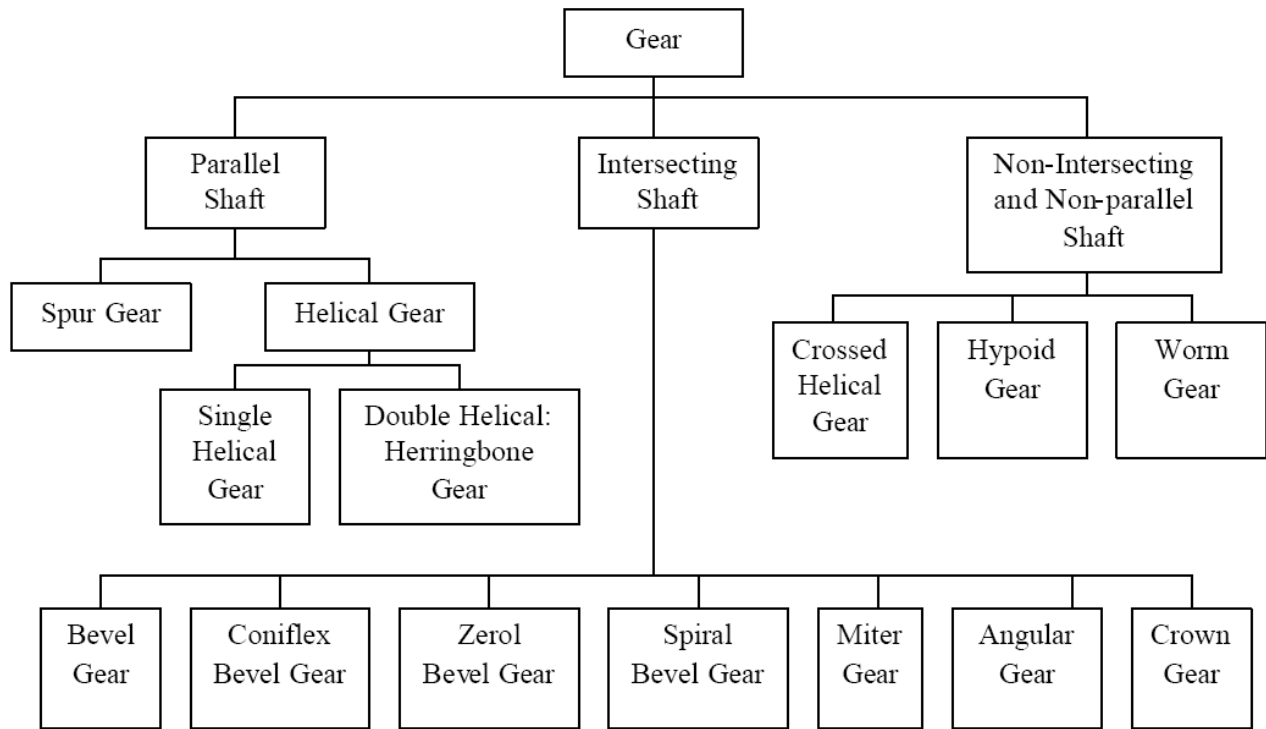
### According to Teeth Position

According to this classification, gears are straight, inclined and curved.

1. **Straight gear teeth** are those where the teeth axis is parallel to the shaft axis.
2. **Inclined gear teeth** are those where the teeth axis is at some angle.
3. **Curve gear teeth** are curved on the rims surface.

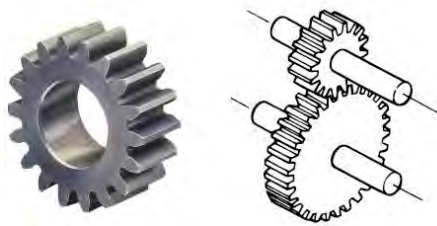
## TYPE OF GEARS

Here is a brief list of the common forms.



## SPUR GEARS

Spur gears are used to transmit power between two parallel shafts. The teeth on these gears are cut straight and are parallel to the shafts to which they are attached.



**Spur Gears**

### Characteristics:

- Simplest and most economical type of gear to manufacture.
- Speed ratios of up to 8 (in extreme cases up to 20) for one step (single reduction) design; up to 45 for two step design; and up to 200 for three-step design.

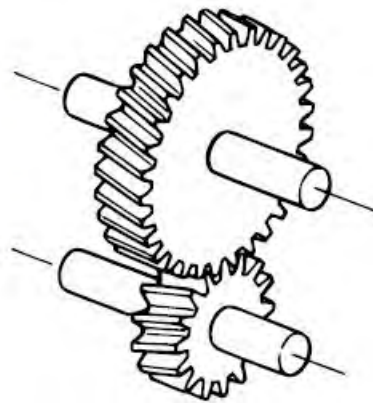
### Limitations:

- Not suitable when a direction of rotation change is required.
- Produce axial thrust forces proportional to the width of the mating teeth instantaneously.

### HELICAL GEARS

Helical gears resemble spur gears but their teeth are cut at an angle to the axis like on spur gears. The angle of helix of the teeth is called the helix angle. To ensure that the gear tooth remains in contact. For parallel shafts, the helix angle of one gear must be equal and opposite to that of the other to avoid excessive end thrust.

*To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course. Close this window and click "Add to cart" on the product page.*



**Helical Gears**