FAQ

Module-5: Helical, bevel and worm gears

1) Why the helical gear having same transverse module and number of teeth as that of spur gear is smaller in size?

The pitch radius of helical gear is equal to $(m_n z)/2$, whereas, $m_n = m_t \cos\phi$. Hence, radius of pitch cylinder, $r = \left(\dfrac{m_t z}{2}\right)\cos\phi$. In the case of spur gear $r = (m_t z)/2$, where, $m_t = m$.

2) Why parallel helical gears are used on drawing machine?

The drawing machine runs at very high speed compared to other machines. The pitch line velocities are very high and hence, parallel helical gears are used.

3) Parallel helical gears are generally recommended for high speed applications. But they are used on the back drafting rollers of ring spinning machine, where the pitch line velocity is the least. Why?

The setting between the back and middle drafting rollers is the least. Rollers can't be set closely if we use large gears. Helical gears are smaller in size compared to spur gears for a given number of teeth. Further, the load on the back drafting roller is more in order to grip large number of fibres. Hence, the use of helical gears is justified.

4) Herringbone gears eliminate thrust load on shaft. Why can't we use them to drive bobbins and flyers on roving machine?

Herringbone gears can be used for parallel shafts. Since the driving and driven shafts are perpendicular to each other, they can't be used. Spiral and straight bevel gears can be tried if we are able to contain the large thrust loads on the driving shaft.

5) We are eliminating thrust load on the driving shafts of bobbins/flyers with the use of crossed helical gears. But it generates thrust load on the shafts of bobbin and flyers. Why this anomaly?

The thrust load on individual shafts of bobbin/flyer are of lesser magnitude and are in one direction depending on whether the shafts are in front or back row. This can be contained with the use of regular bearing that can support both radial and thrust loads (deep groove or angular contact bearings). The cumulative thrust load on driving shaft is also unidirectional but is very large, as each shaft (front and back) drives around 54 or more flyers/bobbins. This can't be contained by the available bearings; considering 50% of load is thrust (helix angle is 45°).

6) What is the main advantage of hypoid bevel gears?

The shaft axes do not intersect with the use of hypoid gears. This permits offsetting of the gears that save the space in low bodied cars/machines.

7) Where do we use miter gears?

It is merely used to change the direction of drive by 90° without any speed reduction. Speed reduction can be carried out through downstream gear train.

8) Why do we use costly phosphor-bronze alloy for making worm gear?

The meshing of worm and worm gear involves high degree of sliding that result in high friction and heating. The above alloy has low friction and better heat transfer compared to other materials.