SCRIET(MECHANICAL DEPATMENT),CCSU MEERUT

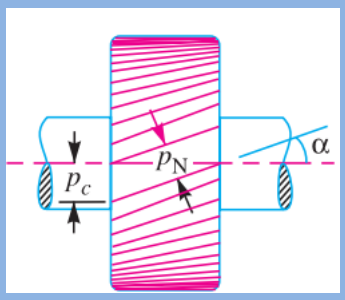
MACHINE DESIGN (Helical Gears LECTURE 5)

Introduction

1. A helical gear has teeth in form of helix around the gear.
2. It is used to connect two parallel shafts.
3. Meshing gears with one is right handed on and left handed on the other.
4. Double helical gears aka herringbone gears are used in which equal and opposite thrusts are provided on each gear and the resulting axial thrust is zero.

Terms used in Helical Gears

1. Helix angle: It is a constant angle made by the helices with the axis of rotation.
2. Axial pitch: It is the distance, parallel to the axis, between similar faces of adjacent teeth. It is the same as circular pitch and is therefore denoted by p_c.
3. Normal pitch. It is the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth. It is denoted by p_N, $p_N = p_c \cos \alpha$

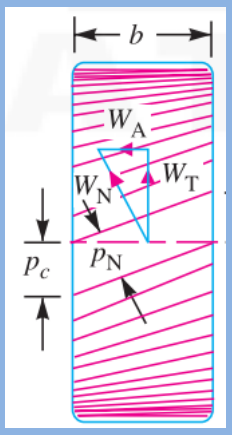


Forces on Helical Gear

a) **Tangential component of force (W_T):** The direction of tangential component for a driving gear is opposite to the direction of rotation, and that for driven gear is same as the direction of rotation,

b) **Radial component of force (W_N):** The radial component on the pinion acts towards the center of the pinion and on the gear acts towards the center of gear.

c) **Axial component of force (W_A):** The direction of thrust component for the driven gear will be opposite to that for the driving gear.



Equivalent Number of Teeth for Helical Gears

It is defined as the number of teeth that can be generated on the surface of a cylinder having a radius equal to the radius of curvature at a point at the tip of the minor axis of an ellipse obtained by taking a section of the gear in the normal plane. Mathematically, formative or equivalent number of teeth on a helical gear,

$T_E = T / \cos^3 \alpha$

where T = Actual number of teeth on a helical gear, and α = Helix angle.

Proportions for Helical Gears(for knowledge only, no need to memorize)

The following are recommended by American Gear Manufacturer's Association (AGMA).

Pressure angle in the plane of rotation, ϕ = 15° to 25°

Helix angle, α = 20° to 45°

Addendum = 0.8 m (Maximum) Dedendum = 1 m (Minimum) Minimum total depth = 1.8 m

Minimum clearance = 0.2 m

Thickness of tooth = 1.5708 m

Strength of Helical Gears

1. To find the **strength of helical gears**, a modified Lewis equation is used. It is given by

$W_T = (\sigma_o \times C_v)\, b.\pi\, m.y'$

where W_T = Tangential tooth load, σ_o = Allowable static stress(from databook),

C_v= Velocity factor(from databook),b = Face width(from standard),

m = Module, and y' = Tooth form factor or Lewis factor corresponding to the virtual or equivalent number of teeth.

2. The **dynamic tooth load** on the helical gears is given by W_D(from databook, no need to memorize).

3. The **static tooth load or endurance strength** of the tooth is given by $W_S = \sigma_e.b.\pi\, m.y'$(from databook, no need to memorize).

NOTE: THEORY RELATED TO THIS CHAPTER HAS BEEN DISCUSSED, ONLY NUMERICALS ARE LEFT WHICH REQUIRE DATABOOK)