Stresses in helical springs

Types of helical spring

1. Open coiled helical spring

2. Close - coiled helical spring

Comparison of close and open coil helical spring

Closed coiled helical spring	**Open-coiled Helical springs**
Helix angle is very small i.e. the pitch between two adjacent turns is small.	Helix angle is more.
Since the helix angle is small bending effect of spring is ignored.	Bending effect of spring is considered.
Subjected to pure torsional stresses.	Subjected to both torsional and bending stress.

Maximum stress induced in the spring:

Maximum shear stress, fs = $\frac{16\,WR}{\pi d^3}$

whereW = Axial load in N

R = Radius (mean) of spring coil in mm

d = diameter of spring wire in mm.

Solid length of spring:

It is the distance between the coils when the coils are touching each other. It is equal to the product of number of coils and diameter of spring wire, i.e., Solid length = n×d.

Types of stresses in a helical spring:

Direct shear stress

Torsional shear stress

Stiffness of a spring:

Stiffness of a spring is the load required to produce unit deformation. It is denoted by 'k',

i. e.,Stiffness (k) = $\frac{\text{Load (W)}}{\text{Deformation } (\delta)}$.

Let us talk about strain energy:

U = $\frac{q^2}{4C}$ × Volume

WhereU = Strain energy stored in spring in N mm.

q = Shear stress induced in spring in N/mm^2

C = Shear modulus in N/mm^2.

and volume of spring= $\frac{\pi}{4}$ d^2 × Length of wire

where d is the diameter of spring wire.

Problems

A close coiled helical spring is to carry an axial load of 500 N. Its mean coil diameter is to be 10 times its wire diameter. Calculate these diameters if the maximum shear stress in the material is to be 80 M Pa.

Given, W = 500 N,D=10d,f_s = 80N/mm^2D = 10 d

Using the equation,

$$f_s = \frac{16WR}{\pi d^3} \quad (\because D = 10d)$$

$$80 = \frac{16 \times 500 \times 5d}{\pi d^3} \quad (\text{or } R = 5\ d)$$

Solving,d = 12.61 say l3 mm

∴ Mean coil diameter,

D = 10d

= **10 × 13 = 130 mm.**