RoyMech

Mechanics

Spiral Spring Design

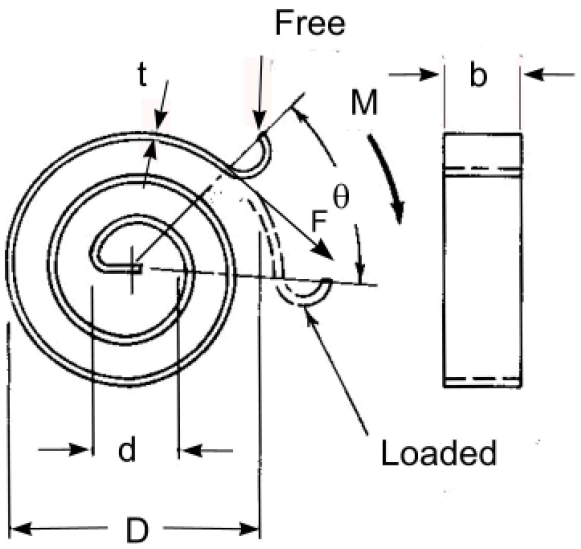
Introduction

A spiral spring consists of a strip or wire wound in a flat spiral . This is subject to a torque to produce an angular deflection. A typical spiral spring is a clock spring

Nomenclature

D = Outside diameter of spring (m)
b = Width of spring strip (m)
d = Inside diameter of spring (m)
t = thickness of spring strip (m)
n = Number of turns of spring
k = Spring rate = M /θ Nm/rad.
E = Young's Modulus (N/m^2)
M = Moment/torque on spring = F.D / 2(Nm)
L = Length of strip (m)
G = Modulus of Rigidity (N/m^2)
I = Second moment of intertia of spring strip (m^4)
F = Force to deflect spring N
y = distance from neutral axis to outer fibre of wire/strip = y/2 (m)
θ = Deflection (radians)
α = Tensile/compressive stress resulting from spring deflection (N/m^2

Note: metres (m) have been shown as the units of length in all of the variables above for consistency. In most practical calculations milli-metres will be more convenient.



Spring Rate

The spring rate k is defined on this webpage as the torque (Nm)per unit angular deflection (θ).

$$k = \frac{M}{\theta}$$

Spiral Spring Formulae

Iength of Strip

$$L = \frac{\pi n(D+d)}{2}$$

Spring Rate

$$k = \frac{E.b.t^3}{12.L}$$

Spring sureface stress

$$\sigma = \frac{6.M}{b.t^2}$$

Links to Spring Design

1. Harris Springs ...Information on Design, Materials etc (Imperial) and a catalog
2. Lee Springs ...Spring Supplier + useful technical Information
3. Springmasters ...Spring Supplier + comprehensive range of springs with sizes and ratings

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RoyMech was created by Roy Beardmore

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