

Here are the formula you need:-

Torque that can be transmitted by an interference fit without slipping:-

$$T = f \cdot P_c \cdot 3.142 \cdot d^2 \cdot L / (2) \quad \text{OK.}$$

where f = friction coefficient

P_c = contact pressure between the two members

d = nominal shaft dia

L = length of external member.

to calculate P_c for a given interference use the formula:-

$$P_c = x / \left[D_c \cdot \left[\frac{(D_c^2 + D_i^2)}{E_i (D_c^2 - D_i^2)} + \dots \dots \dots \right. \right. \\ \left. \left. \frac{(D_o^2 + D_c^2)}{E_o (D_o^2 - D_c^2)} - \left(\frac{U_i}{E_i} + \frac{U_o}{E_o} \right) \right] \right]$$

where x = total interference

D_c = dia of the contact surface

D_i = dia of inner member

D_o = outside dia of outer member

U_o = poisson's ratio for outer member

U_i = poisson's ratio for inner member

E_o = modulus of elasticity for outer member

E_i = modulus of elasticity for inner member

Correct:

$$P_c = \frac{x}{D_c} \left(\frac{D_c^2 + D_i^2}{E_i (D_c^2 - D_i^2)} + \frac{D_o^2 + D_c^2}{E_o (D_o^2 - D_c^2)} + \left(-\frac{U_i}{E_i} + \frac{U_o}{E_o} \right) \right)^{-1}$$

Interference fits

$$P_c = \frac{u_t}{D_c} \cdot \frac{1}{\left(\frac{D_c^2 + D_i^2}{E_i(D_o^2 - D_i^2)} \right) + \left(\frac{D_o^2 + D_c^2}{E_o(D_o^2 - D_c^2)} \right) - \frac{\nu_i}{E_i} + \frac{\nu_o}{E_o}}$$

- P_c = interface pressure
U_t = total displacement (shaft + hub)
D_c = contact diameter
D_i = inner dia of shaft
D_o = outer dia of hub
V_i = Poisson's ratio of shaft material
V_o = Poisson's ratio of hub material
E_i = Young's modulus of shaft material
E_o = Young's modulus of hub material

$$T = COF \cdot P_c \cdot \frac{\pi \cdot d^2 \cdot l}{2}$$

- T = torque
COF = friction between the two materials
P_c = interface pressure
d = contact dia
l = length of engagement