التاريخ / / ٢٠١

الموضوع :

$T = \frac{G\theta}{L} J$

$\theta = \frac{TL}{JG}$

$L = m$

$T : N.m$

$J : m^4$

$G : N/m^2$

$\theta :$ rad

~~1 rad = 57.3 deg~~

$rad = \frac{2\pi}{360}$ deg

$deg = 57.3$ rad

Substitute $\frac{T}{J} = \frac{G\theta}{L}$ from equ① $\left(\frac{\tau}{\rho} = \frac{G\theta}{L}\right)$

$\tau = \frac{T}{J}\rho$

$\rho \rightarrow$ max value r

$\boxed{\max \tau = \frac{T.r}{J}}$

$\max \tau = \frac{T.\frac{d}{2}}{\frac{\pi d^4}{32}} = \boxed{\frac{16T}{\pi d^3}}$ solid shaft

$= \boxed{\frac{16TD}{\pi(D^4 - d^4)}}$ hollow shaft

* Shaft transmitted power

$P = T.\omega$

$\omega :$ radians/s

$\omega = 2\pi f$

$f :$ frequency revolution/time

$P = 2\pi f.T$

$P :$ Watt $= N.m/s$

$f : r/s$, $T : N.m$

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Solid shaft

$P = 20\,kW$

$f = 2\,r/s$

$d = ?$

$\tau_{max} = 40\,MN/m^2$

$\theta = 6^\circ$

$L = 3\,m$

$G = 83\,GN/m^2$

Solu:

$P = T \cdot \omega$

$= T \cdot 2\pi f$

$$T = \frac{P}{2\pi f} = \frac{20\times10^3}{2\pi\times2} = 1590\,N.m$$

$$\tau = \frac{16T}{\pi d^3} \quad , \quad 40\times10^6 = \frac{16\times1590}{\pi d^3}$$

$d = 58.7\,mm$

$$\theta = \frac{T \cdot L}{G J}$$

$$6 \times \frac{1}{57.3} = \frac{1590\times3}{83\times10^9 \times J\left(\frac{\pi}{32}d^4\right)}$$

$d = 48.6\,mm$

$\therefore d = 58.7$ safety