Solutions

2.1

- $\tau_{max} = 16T/\pi d^3 = 9600/(0.2011 \times 10^{-3}) = \mathbf{47.7}$ MPa.
- $J = \pi(0.04)^4/32 = 2.513 \times 10^{-7}$ m^4; $\phi = 1200/(2.011 \times 10^4) = \mathbf{0.0597}$ rad.
- $\phi = 0.0597 \times 180/\pi = \mathbf{3.42}^\circ$.

2.2

- $\omega = 2\pi(240)/60 = 25.13$ rad/s.
- $P = T\omega = 600 \times 25.13 = \mathbf{15.1}$ kW.

2.3

- $d^3 = 16 \times 800 \times 10^3/(\pi \times 75) = \mathbf{54{,}330}$ mm^3, so $d = \mathbf{37.9}$ mm.

2.4

- Zero on the axis, worst at the surface: $\tau = T\rho/J$ is linear in radius.
- $\phi = TL/GJ$ is linear in L - twist accumulates along the shaft.

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