

20-R-WE-DK-7 Beginner Principle of Work and Energy



If a couple moment $M = (\theta^2 + 2\theta) \text{ Nm}$ is applied to a disk, determine the angular velocity of the disk after it has rotated 4 times. The disk has a mass $m = 10 \text{ kg}$ and radius $r = 10 \text{ cm}$.

$$I_G = \frac{1}{2} m r^2 = \frac{1}{2} (10) (0.1)^2 = 0.05 \text{ kg m}^2$$

$$U_M = \int M d\theta = \int_0^{4(2\pi)} (\theta^2 + 2\theta) d\theta = \left[\frac{1}{3} \theta^3 + \theta^2 \right]_0^{8\pi} = 5973.658051$$

$$T_1 + \sum U_{1 \rightarrow 2} = T_2 \quad 0 + 5973.658051 = T_2$$

$$T_2 = \frac{1}{2} I_G \omega^2 = \frac{1}{2} (0.05) \omega^2 \quad 5973.658051 = \frac{1}{2} (0.05) \omega^2$$

$$\omega = 484.42136 \text{ rad/s}$$