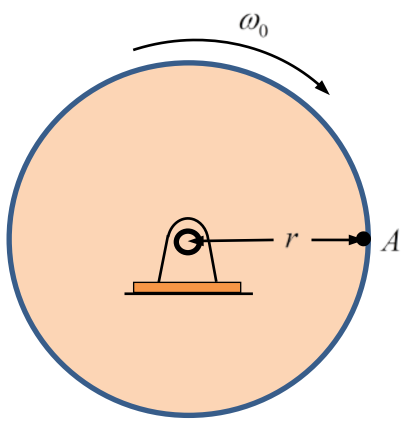
3-1. A disk rotates at $\omega_0 = 2$ rad/s and a constant angular acceleration of $\alpha = 2$ rad/s$^2$. The disk has a radius that follows a normal distribution $r \sim N(5, 0.2^2)$ ft. When $t = 1$ s, determine the distributions of both normal and tangential acceleration components at point *A*.




Solution:

$$\omega = \omega_0 + \alpha t$$

$$v = r\omega$$

$$a_t = r\alpha$$

Thus

$$\mu_{a_t} = \mu_r \alpha = 10 \text{ ft/s}^2$$

$$\sigma_{a_t} = \sigma_r \alpha = 0.4 \text{ ft/s}^2$$

$$a_n = r\omega^2 = r\left(\omega_0 + \alpha t\right)^2$$

$$\mu_{a_n} = \mu_r \left(\omega_0 + \alpha t\right)^2 = 80 \text{ ft/s}^2$$

$$\sigma_{a_n} = \sigma_r \left(\omega_0 + \alpha t\right)^2 = 3.2 \text{ ft/s}^2$$

Therefore, $a_t \sim N(10, 0.4^2)$ ft/s$^2$ and $a_n \sim N(80, 3.2^2)$ ft/s$^2$. **Ans.**