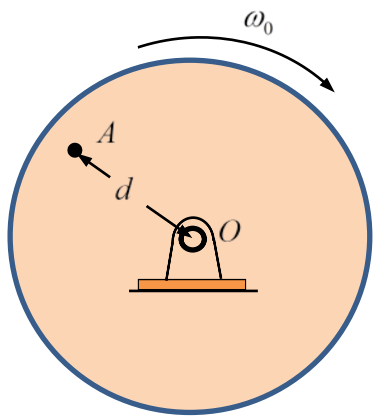
3-2. A disk rotates at $\omega_0 = 2$ rad/s and a constant angular acceleration of $\alpha = 2$ rad/s^2. The distance between points A and O follows a normal distribution $d \sim N(4, 0.2^2)$ ft. Determine the distributions of both normal and tangential acceleration components at point A after the disk undergoes three revolutions.



Solution:

$$\omega^2 = \omega_0^2 + 2\alpha\left(\theta - \theta_0\right)$$

$$\begin{aligned}\omega &= \sqrt{\omega_0^2 + 2\alpha\left(\theta - \theta_0\right)} \\ &= \sqrt{\omega_0^2 + 2\alpha\left(3\left(2\pi\right) - 0\right)} \\ &= 8.91 \text{ rad/s}\end{aligned}$$

$$a_t = r\alpha$$

Thus,

$$\mu_{a_t} = \mu_r \alpha = 8 \text{ ft/s}^2$$

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

$$a_n = \omega^2 r$$

$$\mu_{a_n} = \mu_r \omega^2 = 317.6 \text{ ft/s}^2$$

$$\sigma_{a_n} = \sigma_r \omega^2 = 15.9 \text{ ft/s}^2$$

Therefore, $a_t \sim N(8, 0.4^2)$ ft/s^2 and $a_n \sim N(317.6, 15.9^2)$ ft/s^2. **Ans.**