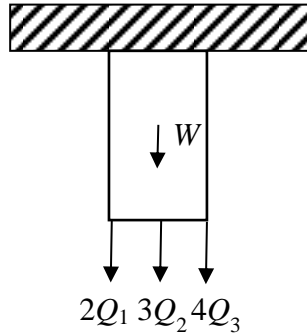


9. Three independent random forces act on the component as shown. Their distributions are $Q_1 \sim N(10, 1^2)$ kN, $Q_2 \sim N(20, 2^2)$ kN, and $Q_3 \sim N(30, 3^2)$ kN. The weight of the component is $W = 5$ kN. What is the distribution of the resultant force?



Solution

$$Q_1 \sim N(10, 1^2) \text{ kN}$$

$$Q_2 \sim N(20, 2^2) \text{ kN}$$

$$Q_3 \sim N(30, 3^2) \text{ kN}$$

$$Y = W + 2Q_1 + 3Q_2 + 4Q_3$$

$$\mu_Y = W + 2\mu_1 + 3\mu_2 + 4\mu_3 = 5 + 2(10) + 3(20) + 4(30) = 205 \text{ kN}$$

$$\sigma_Y = \sqrt{(2\sigma_1)^2 + (3\sigma_2)^2 + (4\sigma_3)^2} = \sqrt{[2(1)]^2 + [3(2)]^2 + [4(3)]^2} = 13.56 \text{ kN}$$

$$Y \sim N(205, 13.56^2) \text{ kN}$$