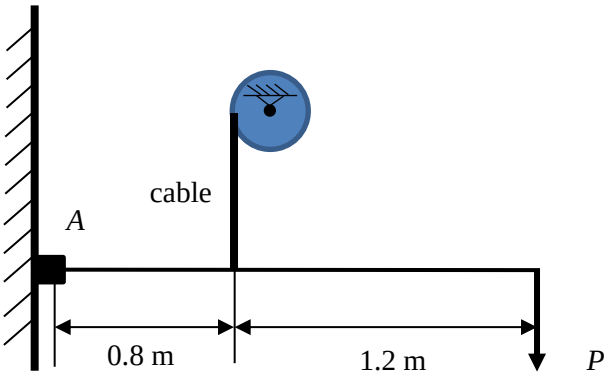
30. The resistance of the cable follows a normal distribution $S \sim (2800, 30^2)$ N. Determine the probability that the cable will break if a force applied in the system is $P \sim (1100, 10^2)$ N. S and P are independently distributed.



Solution

$$\Sigma M_A = 0; \;\; T(0.8) - P(0.8 + 1.2) = 0$$

$$T = 2P / 0.8$$

$$\mu_T = 2\mu_P / 0.8 = 2750 \text{ N}$$

$$\sigma_T = 2\sigma_P / 0.8 = 25 \text{ N}$$

We construct the function

$$Y = S - T$$

$$\mu_Y = \mu_S - \mu_T = 50 \text{ N}$$

$$\sigma_Y = \sqrt{\sigma_S^2 + \sigma_T^2} = 39 \text{ N}$$

The probability that the cable will break is

$$p_f = \Pr(Y < 0) = \Phi(-\mu_Y / \sigma_Y) = 0.1 \qquad \textbf{Ans.}$$