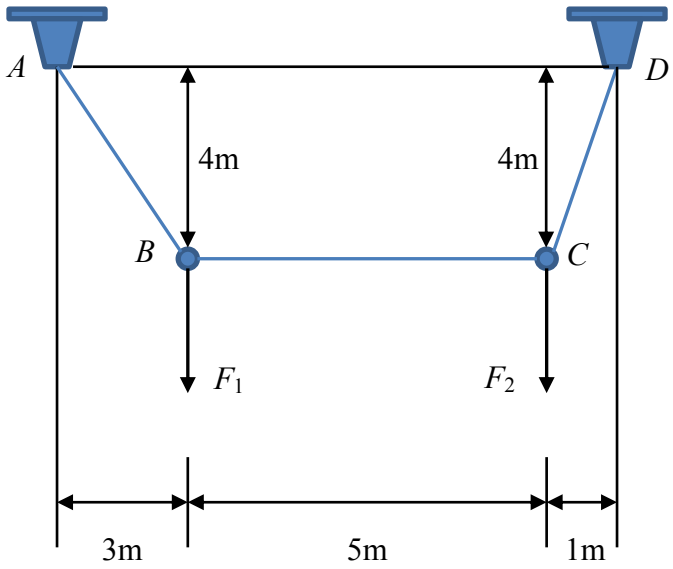
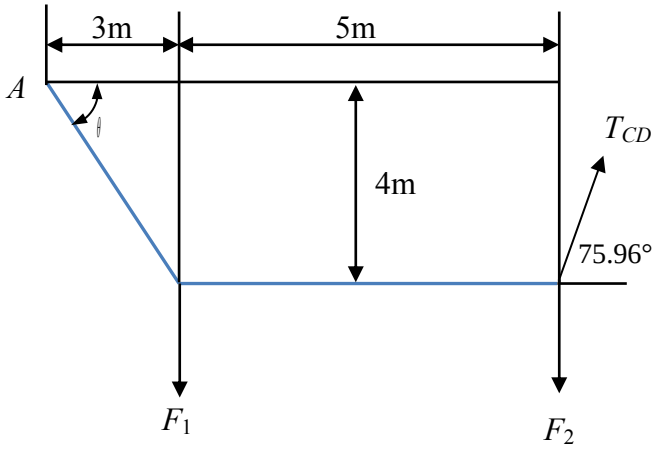
6. Two independent forces $F_1 \sim N(12, 0.5^2)$ kg and $F_2 \sim N(18, 0.5^2)$ kg act at points B and C of cable $ABCD$. (1) Determine the tension in the cable CD. (2) If the maximum load of the cable is 210 N, what is the probability the cable CD might fail?



Solution



(1) From *FBD*, we have:

$$\sum M_A = 0; \quad T_{CD}\cos 75.96^\circ (4) + T_{CD}\sin 75.96^\circ (8) - F_2(9.81)(8) - F_1(9.81)(3) = 0$$

Then, we can obtain the distribution of T_{CD}:

$$\mu_{T_{CD}} = \frac{\mu_{F_2}(9.81)(8) + \mu_{F_1}(9.81)(3)}{\cos 75.96^\circ (4) + \sin 75.96^\circ (8)} = 202.23 \text{ N}$$

$$\sigma_{T_{CD}} = \frac{(9.81)\sqrt{\sigma^2{}_{F_2}(64) + \sigma^2{}_{F_1}(9)}}{\cos 75.96^\circ (4) + \sin 75.96^\circ (8)} = 4.80$$

Thus, the distribution of cable *CD* is:

$$T_{CD} \sim N(202.23, 4.80^2) \text{ N}.$$ **Ans.**

(2) If the maximum load of the cable *CD* is 210N, then the probability that the system might fail is:

$$P(T_{CD} \geq 210) = 1 - P(T_{CD} < 210) = 1 - \Phi(\frac{210 - 202.23}{4.8}) = 0.0529$$ **Ans**.