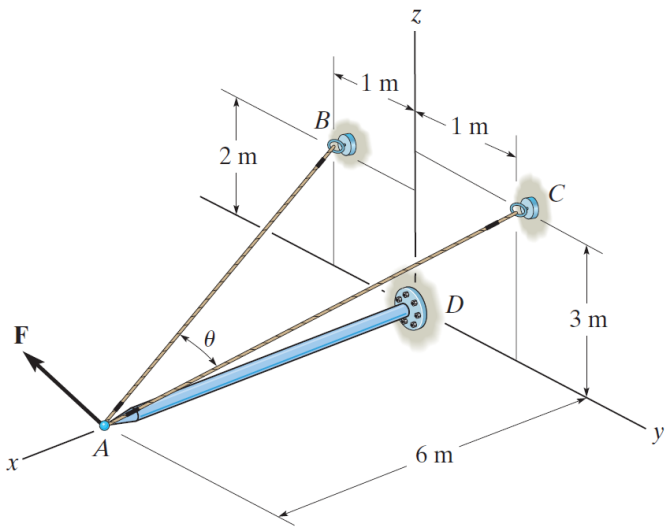
Problem 2-122

Determine the angle θ between the cables AB and AC.



Probs. 2–122/123/124

Solution

Write the position vectors to the points A, B, and C.

$$\mathbf{r}_A = \langle 6, 0, 0 \rangle \text{ m}$$

$$\mathbf{r}_B = \langle 0, -1, 2 \rangle \text{ m}$$

$$\mathbf{r}_C = \langle 0, 1, 3 \rangle \text{ m}$$

The unit vector going from A to B is

$$\hat{\mathbf{u}}_{AB} = \frac{\mathbf{r}_B - \mathbf{r}_A}{|\mathbf{r}_B - \mathbf{r}_A|} = \frac{\langle -6, -1, 2 \rangle}{\sqrt{(-6)^2 + (-1)^2 + (2)^2}},$$

and the unit vector going from A to C is

$$\hat{\mathbf{u}}_{AC} = \frac{\mathbf{r}_C - \mathbf{r}_A}{|\mathbf{r}_C - \mathbf{r}_A|} = \frac{\langle -6, 1, 3 \rangle}{\sqrt{(-6)^2 + (1)^2 + (3)^2}}.$$

Take the dot product of these unit vectors.

$$\cos\theta = \hat{\mathbf{u}}_{AB} \cdot \hat{\mathbf{u}}_{AC} = \frac{\langle -6, -1, 2 \rangle}{\sqrt{(-6)^2 + (-1)^2 + (2)^2}} \cdot \frac{\langle -6, 1, 3 \rangle}{\sqrt{(-6)^2 + (1)^2 + (3)^2}} = \sqrt{\frac{41}{46}}$$

Therefore, the angle between $\mathbf{F}_1$ and $\mathbf{F}_2$ is

$$\theta = \cos^{-1}\left(\sqrt{\frac{41}{46}}\right) \approx 19.3°.$$