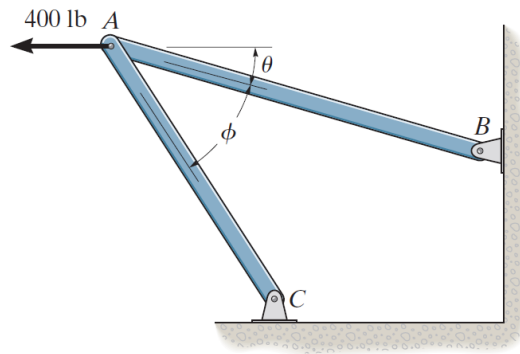


### Problem 2-20

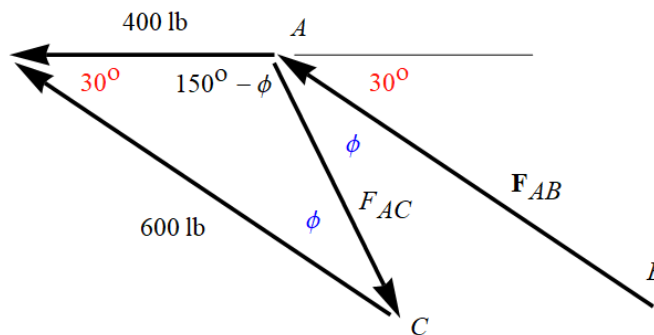
Determine the design angle  $\phi$  ( $0^\circ \leq \phi \leq 90^\circ$ ) between struts  $AB$  and  $AC$  so that the 400-lb horizontal force has a component of 600 lb which acts up to the left, in the same direction as from  $B$  towards  $A$ . Take  $\theta = 30^\circ$ .



Probs. 2–19/20

### Solution

Draw the triangle that the 400-lb horizontal force and its components along members  $AB$  and  $AC$  make.



Use the law of cosines to determine the magnitude of  $\mathbf{F}_{AC}$ .

$$F_{AC}^2 = 400^2 + 600^2 - 2(400)(600) \cos 30^\circ$$

$$F_{AC} = \sqrt{400^2 + 600^2 - 2(400)(600) \cos 30^\circ}$$

$$\approx 323 \text{ lb}$$

Then use the law of sines to determine  $\phi$ .

$$\frac{400 \text{ lb}}{\sin \phi} = \frac{F_{AB}}{\sin 30^\circ} \rightarrow \sin \phi = \frac{400 \text{ lb}}{F_{AB}} \sin 30^\circ \rightarrow \phi \approx 38.3^\circ$$