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8.36. Spring CD connects the horizontal position at C to the vertical position at D. If the spring is unstretched when $\theta = 0^\circ$ and the constant $k = 17.5 \text{ kN/m}$, determine the constant angle θ for equilibrium and the horizontal and vertical components of reaction at A.

Spring Force Formula: At the equilibrium position, the spring elongates $s = 0.36 \text{ m}$. Using the spring force formula, the force in spring CD is found to be $F_{CD} = k s = 17.5(0.36) = 6.3 \text{ kN}$.

Equation of Equilibrium: From the free-body diagram of the bracket, Fig. a, the equilibrium position θ and A_x can be obtained by writing the moment equation of equilibrium about point A and the force equations of equilibrium along the x and y axes, respectively.

$$\sum M_A = 0: \quad 900 \cos \theta (0.6) - 900 \sin \theta (0.6) - 300 \cos \theta (0.45) = 0$$
$$900 \cos \theta - 900 \sin \theta - 135 \cos \theta = 0$$

Solving by trial and error yields:

$$\theta = 23.867^\circ = 23.9^\circ \quad \text{Ans.}$$
$$\sum F_x = 0: \quad A_x - 300 = 0 \quad \text{Ans.}$$
$$A_x = 300 \text{ N}$$

Using the result $\theta = 23.867^\circ$ and writing the force equations of equilibrium along the y axis:

$$\sum F_y = 0: \quad A_y - 900 \sin 23.867^\circ = 0 \quad \text{Ans.}$$
$$A_y = 352.86 \text{ N} = 353 \text{ N}$$

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