EXAMPLE 3-2

The members of the truss in Fig. 3-8 have equal cross-sectional areas $A = 400\ \text{mm}^2$. The suspended mass is $m = 3400$ kg. What are the normal stresses in the members?

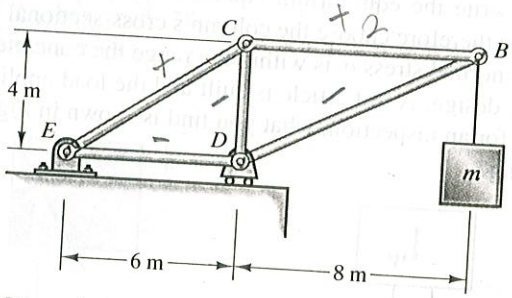


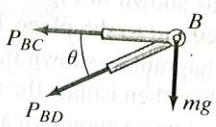
FIGURE 3-8

Strategy

We can use the method of joints to determine the axial force in each member and divide by A to determine the normal stress.

Solution

In Fig. (a) we draw the free-body diagram of joint B of the truss. The angle $\theta = \arctan(4/8) = 26.6°$.



(a)

(a) Joint B.

From the equilibrium equations

$$\Sigma F_x = -P_{BC} - P_{BD}\cos\theta = 0,$$
$$\Sigma F_y = -P_{BD}\sin\theta - mg = 0,$$

we obtain $P_{BC} = 2mg$, $P_{BD} = -2.24mg$. Continuing in this way, we obtain the axial forces:

Member:	BC	BD	CD	CE	DE
Axial force:	$2mg$	$-2.24mg$	$-1.33mg$	$2.40mg$	$-2mg$

Substituting the values $m = 3400$ kg and $g = 9.81\ \text{m/s}^2$ and dividing by $A = 400 \times 10^{-6}\ \text{m}^2$, the stresses are

Member:	BC	BD	CD	CE	DE
Normal stress (MPa):	167	−186	−111	200	−167