Truss Analysis
''Analysis of Statically Determinate Trusses”

Table des matières

The internal forces

I

1. Method of Joints

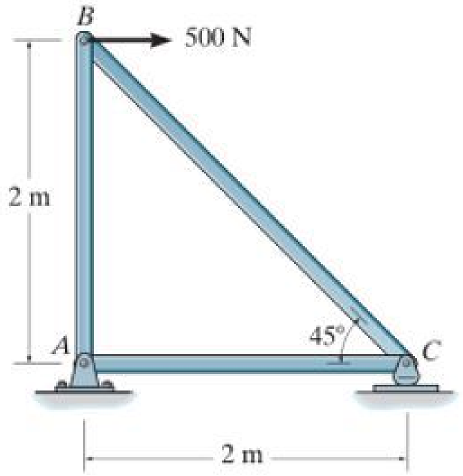
If a truss is in equilibrium, then each of its joints must also be in equilibrium. This method is done by selecting each joint in sequence, having at most one known force and at least two unknowns. The free-body diagram of each joint is constructed and two force equations of equilibrium, $\sum Fx = 0$ and $\sum Fy = 0$, when applying these equations, the correct sense of an unknown member force can be determined using one of two possible methods:

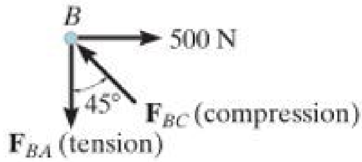
1. Always assume the unknown member forces acting on the joint's free-body diagram to be in tension,i.e., “pulling”on the pin. If this is done, then numerical solution of the equilibrium equations will yield positive scalars for members in tension and negative scalars for members in compression. Once an unknown member force is found, use its correct magnitude and sense (T or C) on subsequent joint free-body diagrams.

2. The correct sense of direction of an unknown member force can, in many cases, be determined “by inspection”.

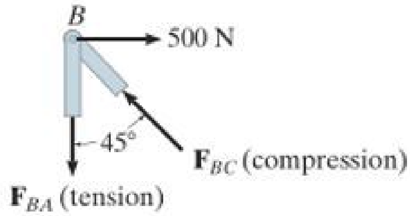
For example, in Figure below must push on the pin (compression) since its horizontal component, sin 45°, must balance the 500-N force.

Likewise, is a tensile force since it balances the vertical component, cos 45° In more complicated cases, the sense of an unknown member force can be assumed; then, after applying the equilibrium equations, the assumed sense can be verified from the numerical results. A positive answer indicates that the sense is correct, whereas a negative answer indicates that the sense shown on the free-body diagram must be reversed.



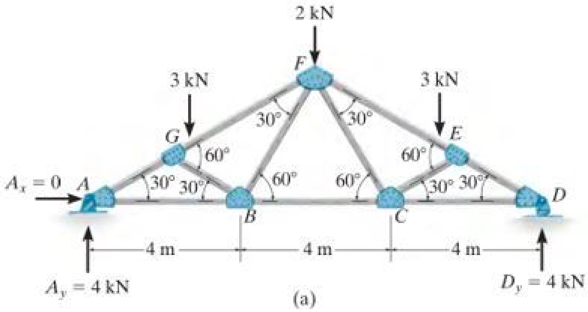


(b)



Exemple

Determine the force in each member of the roof truss shown in the photo. The dimensions and loadings are shown in Figure a. State whether the members are in tension or compression.



(a)

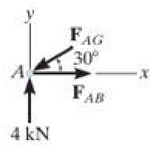
Solution:

Only the forces in half the members have to be determined, since the truss is symmetric with respect to both loading and geometry.

Joint A:

$+\uparrow \Sigma F_y = 0; \quad 4 - F_{AG} \sin 30^\circ = 0 \qquad F_{AG} = 8 \text{ kN (C)}$

$\xrightarrow{+} \Sigma F_x = 0; \quad F_{AB} - 8 \cos 30^\circ = 0 \qquad F_{AB} = 6.928 \text{ kN (T)}$



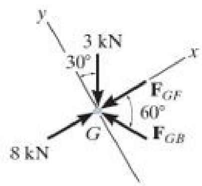
Joint G:

$+\nwarrow \Sigma F_y = 0; \quad F_{GB} \sin 60^\circ - 3 \cos 30^\circ = 0$

$F_{GB} = 3.00 \text{ kN (C)}$

$+\nearrow \Sigma F_x = 0; \quad 8 - 3 \sin 30^\circ - 3.00 \cos 60^\circ - F_{GF} = 0$

$F_{GF} = 5.00 \text{ kN (C)}$



Joint B:

$+\uparrow \Sigma F_y = 0; \quad F_{BF} \sin 60^\circ - 3.00 \sin 30^\circ = 0$

$F_{BF} = 1.73 \text{ kN (T)}$

$\xrightarrow{+} \Sigma F_x = 0; \quad F_{BC} + 1.73 \cos 60^\circ + 3.00 \cos 30^\circ - 6.928 = 0$

$F_{BC} = 3.46 \text{ kN (T)}$