Engineering Mechanics : Statics

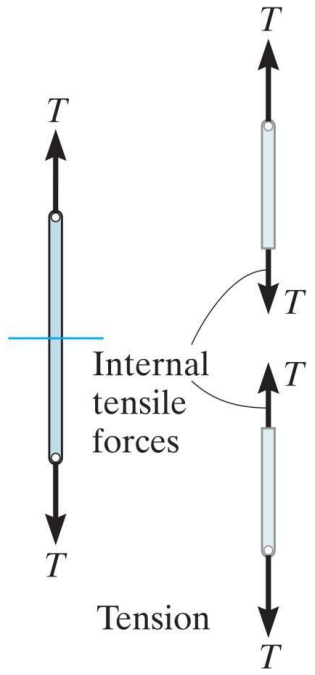
Chapter 6: Structural analysis

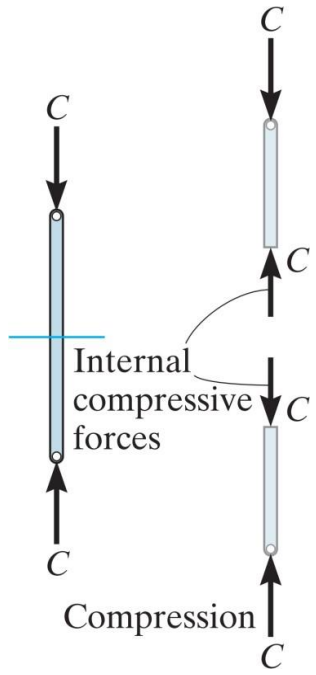
Chapter outline

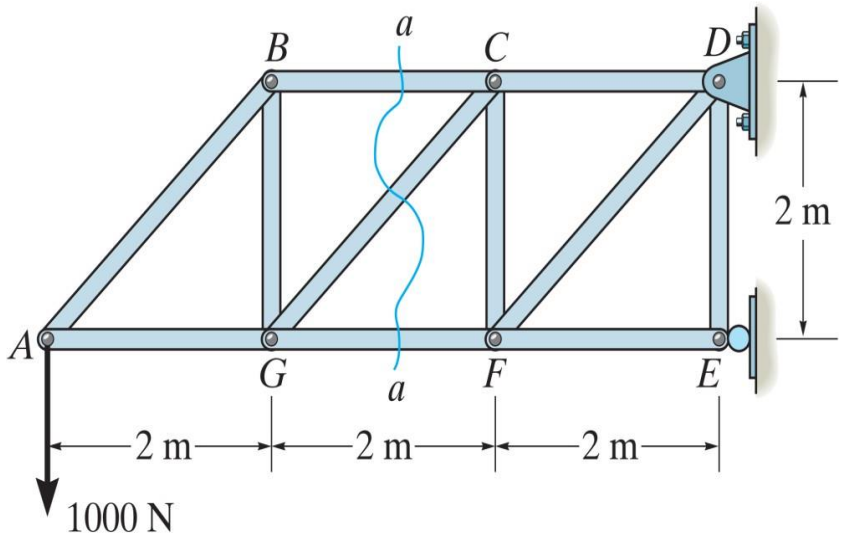
- Simple Trusses
- The Method of Joints
- The Method of Sections

6. 4 The Method of sections

- Used to determine the loadings within a body
- If a body is in equilibrium, any part of the body is in equilibrium
- To determine the forces within the members, an imaginary section indicated by the blue line, can be used to cut each member into two and expose each internal force as external







6. 4 The Method of Sections

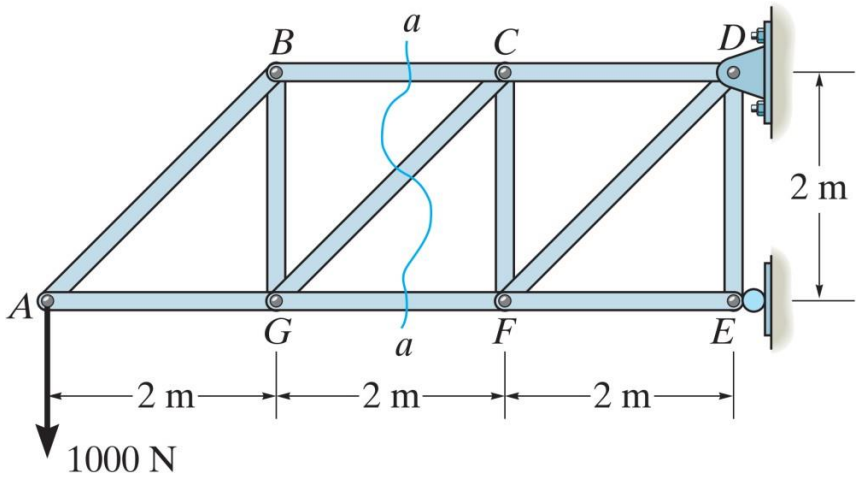
There are 3 types of forces, External, Internal and reactive. Our objective is to find all of these forces.

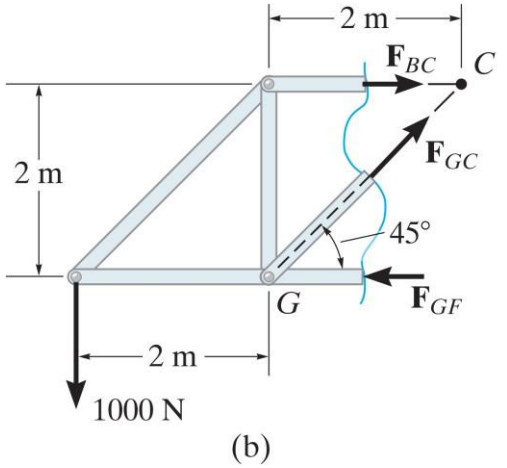
Step 1: Find the reactive forces uses global equilibrium

Step 2: Cut through members of interest (No more than 3 members cut through)

Step 3: Draw free body diagram of the easiest side

Step 4: Solve





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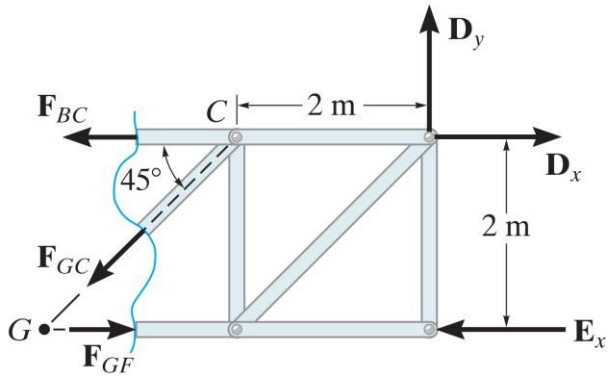
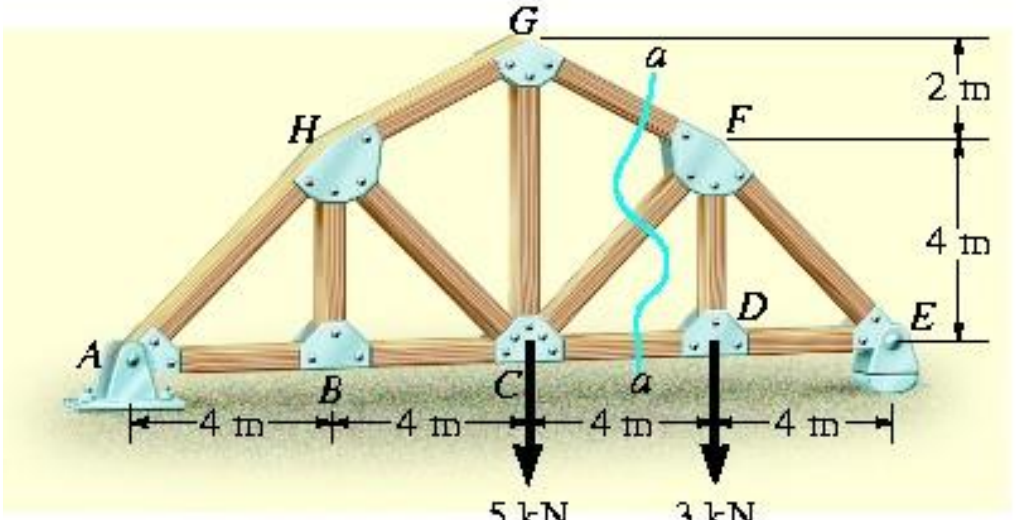


(c)

6. 4 The Method of Sections

Example 6.6

Determine the force in member CF of the bridge truss. Indicate whether the member are in tension or compression. Assume each member is pin connected.

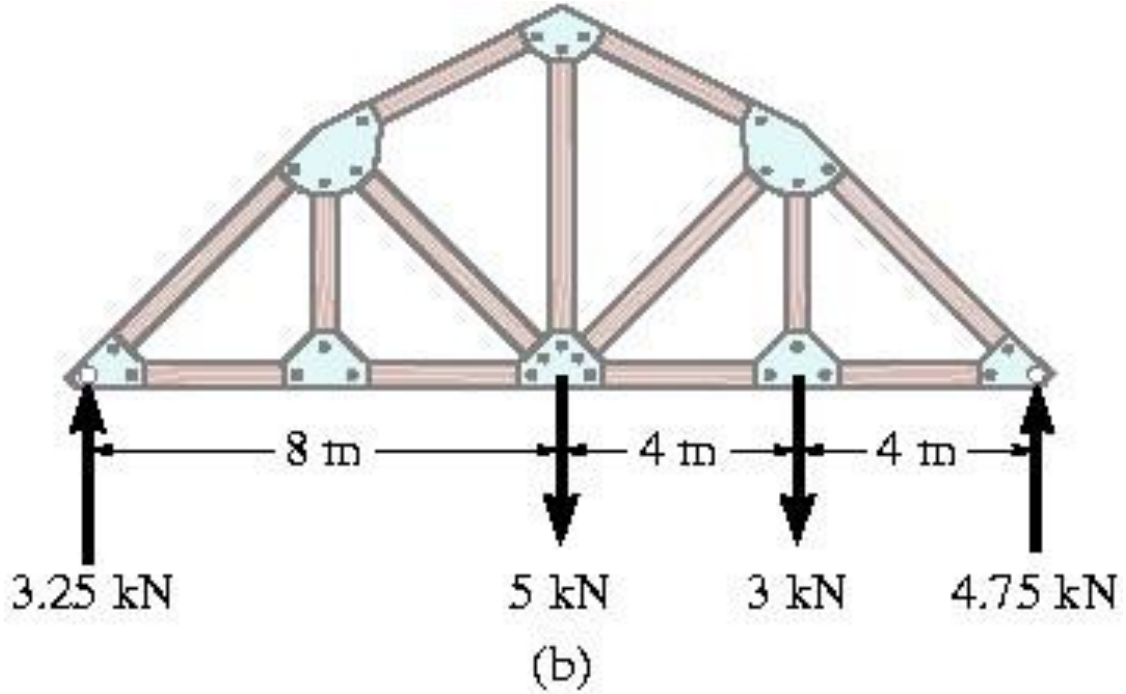


(a)

6. 4 The Method of Sections

Solution

FBD of the entire truss



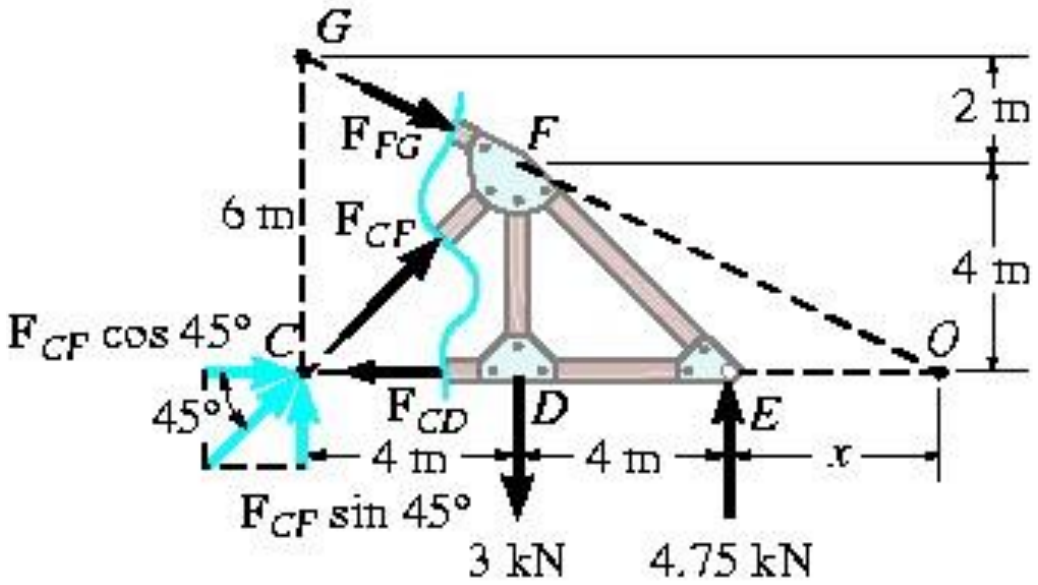
(b)

6. 4 The Method of Sections

Solution

FBD of the sectioned truss

- Three unknown F_{FG}, F_{CF}, F_{CD}



(c)

6. 4 The Method of Sections

Solution

Equations of Equilibrium

- For location of O measured from E

  $4 / (4 + x) = 6 / (8 + x)$

  $x = 4m$

- Principle of Transmissibility

$$\sum M_O = 0;$$

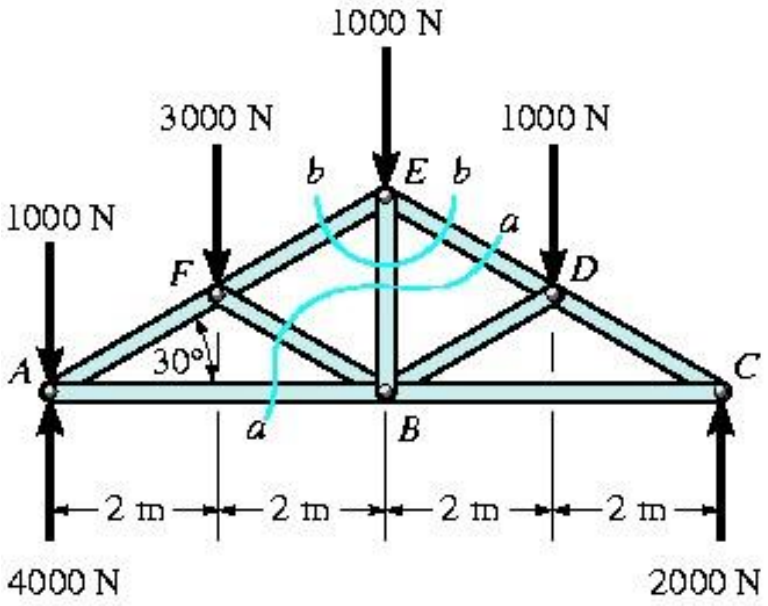
$$-F_{CF} \sin 45^\circ (12m) + (3kN)(8m) - (4.75kN)(4m) = 0$$

$$F_{CF} = 0.589kN(C)$$

6. 4 The Method of Sections

Example 6.7

Determine the force in member EB of the roof truss. Indicate whether the member are in tension or compression.



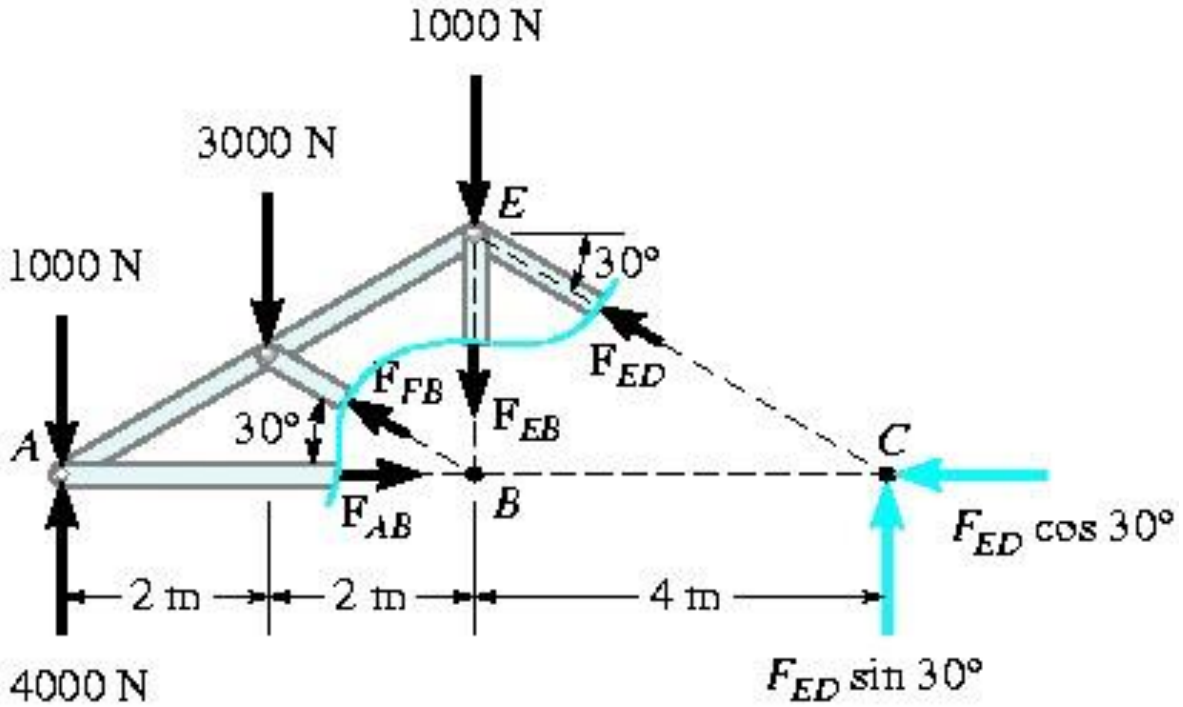
(a)

6. 4 The Method of Sections

View Free Body Diagram

Solution

FBD of the sectioned truss

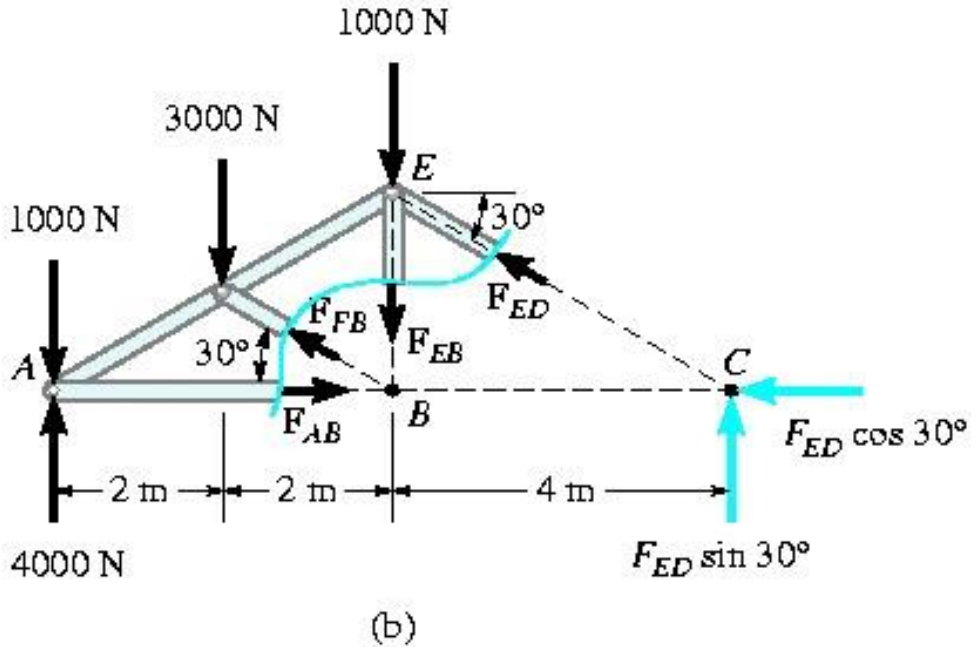


(b)

6. 4 The Method of Sections

Solution

- Force system is concurrent
- Sectioned FBD is same as the FBD for the pin at E (method of joints)



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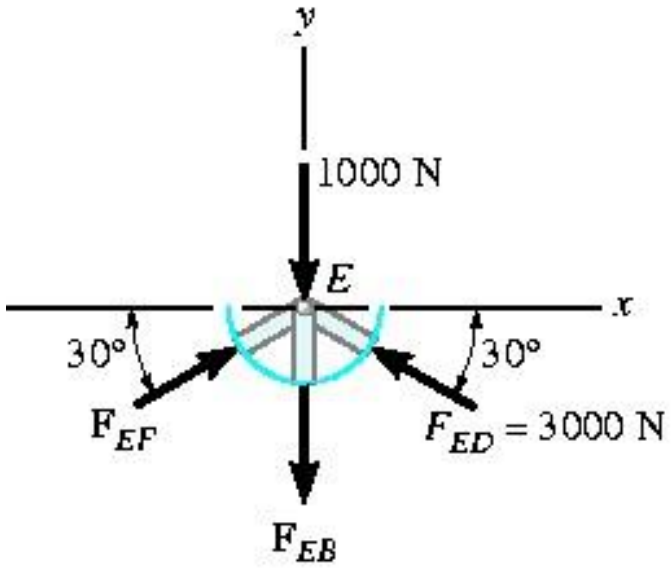

(c)

6. 4 The Method of Sections

Solution

$$\sum M_B = 0;$$

$$1000N(4m) - 3000N(2m) - 4000N(4m) + F_{ED}\sin 30^\circ (4m) = 0$$

$$F_{ED} = 3000N(C)$$

$$+\rightarrow \sum F_x = 0;$$

$$F_{EF}\cos^\circ - 3000\cos 30^\circ N = 0$$

$$F_{EF} = 3000N(C)$$

$$+\uparrow \sum F_y = 0;$$

$$2(3000\sin 30^\circ N) - 1000N - F_{EB} = 0$$

$$F_{EB} = 2000N(T)$$