WORKED SOLUTIONS

ENST2.2: METHOD OF SECTIONS

Question

Determine any reactions, and the forces in members GE, GC and BC of the truss shown below using the method of sections. State if the members are in tension (T) or compression (C).


Worked Solution

Calculate the support forces (reactions) first

\[ \sum F_x = 0 : \quad 400 - F_{AX} = 0 \quad \Rightarrow \quad F_{AX} = 400 \text{ N (left)} \]

\[ +2 \sum M_D = 0 : \quad (400 \times 3) + (F_{AY} \times 12) - (1200 \times 4) = 0 \quad \Rightarrow \quad F_{AY} = 300 \text{ N (up)} \]

\[ +\sum F_y = 0 : \quad 300 + F_{DY} - 1200 = 0 \quad \Rightarrow \quad F_{DY} = 900 \text{ N (up)} \]
Cut or section a-a the truss through the members where the forces are to be found

Note: • Use left side of truss as there are fewer forces acting
• Forces along section are assumed to be in tension
• Only external forces $F_{BC}, F_{GC}, F_{GE}, F_{AY}, F_{AX}$ used

1. $+2 \leq M_G = 0$  Taking moments about $G$ eliminates $F_{GC}, F_{GE}$

   \[(400 \times 3) + (300 \times 4) - (F_{BC} \times 3) = 0 \Rightarrow F_{BC} = 800N(T)\]

2. $+2 \leq M_C = 0$

   Note: • Moment taken about a joint outside of section is still OK
   • Moment about $C$ eliminates $F_{GC}$ and $F_{BC}$

   \[(300 \times 8) + (F_{GE} \times 3) = 0 \Rightarrow F_{GE} = -800N(C)\]

   Note: $F_{GE}$ is $-$, so assumed direction incorrect, i.e., compression

3. $+1 \leq F_Y = 0$

   Note: Moments not required, only $F_{AY}$ and vertical component of $F_{GE}$ needed

   \[300 - F_{GC} \sin \theta = 0 \Rightarrow 300 - F_{GC} \times 3/5 = 0 \Rightarrow F_{GC} = 500N(T)\]

Summary

$F_{AX} = 400N$ (left), $F_{AY} = 300N$ (up), $F_{DY} = 900N$ (up)

$F_{BC} = 800N(T)$, $F_{GE} = 800N(C)$, $F_{BC} = 800N(T)$