To do ...

- HW 13 ME due Thurs
- WA 7 due Sun
- HW 14 PL due Tues
Method of sections

force in that member
Method of sections
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- Determine external support reactions
- “Cut” the structure at a section of interest into two separate pieces and set either part into force and moment equilibrium
- Your cut should be such that you have up to three unknowns

*Method useful for finding unknown forces in only a few bars!

Approach:

\[ \sum F_x = 0 \]
\[ \sum F_y = 0 \]

*If a truss is in equilibrium, then each of its segments are in equilibrium. Internal forces become external forces.

\[ \Rightarrow \text{ decide how to "cut" truss based on where you need to determine forces} \]

\[ \Rightarrow \text{ make a cut through truss} \]
\[ \Rightarrow \text{ become sections} \]
\[ \Rightarrow \text{ cut through bars not joints} \]
\[ \Rightarrow \text{ each section is a rigid body!} \]

\[ \Rightarrow \text{ expose no more than 3 bars!} \]

\[ \Rightarrow \text{ assume all internal loads are tensile} \]

\[ \Rightarrow \text{ use equations of equilibrium} \]
\[ \Sigma M_o = 0 \]

1000 N

\[ \Sigma m = 0 \]

3 unknowns

6 unknowns

Solve either using

\[ \Sigma F_x = 0 \]

\[ \Sigma F_y = 0 \]

\[ \Sigma M_o = 0 \]
Determine the force in member GC and GE of the truss and state if the members are in tension or compression.

1. Draw FBD of truss
2. Draw FBD of sections

\[ \sum M_A: -3(400) - 8(1200) + 12D_y = 0 \]
\[ D_y = \frac{3(400) + 8(1200)}{12} = 900 \text{ N} \]

5 unknowns

4 unknowns

Solve using the right section:

\[ \sum M_C: 4(900) - 3(400) + 3F_\Gamma = 0 \]
Moments about $G$:

\[ \sum M_G: \quad -3 \text{BC} - 4(1200) + 8(900) = 0 \]

\[ \text{BC} = \frac{8(900) - 4(1200)}{3} = 800 \text{ N (T)} \]

Sum forces in y-direction:

\[ \sum F_y: \quad D_y - 1200 + \frac{3}{5} GE = 0 \]

\[ GE = \frac{5}{3} (1200 - D_y) = 500 \text{ N (T)} \]
Find the force in members KJ, KD, and CD.

1. Draw FBD of Huss
2. Draw FBD of sections

* Use global equilibrium to solve for support reaction

\[ \Sigma F_x: \quad A_x = 0 \]
\[ \Sigma F_y: \quad A_y + G_y - 20k - 30k - 40k = 0 \]

Sum moments about A.

\[ \Sigma M_A: \quad 12 G_y - 2(20k) - 4(30k) - 6(40k) = 0 \]

\[ G_y = \frac{2(20k) + 4(30k) + 6(40k)}{12} = 33.3 \text{ kN} \]

Draw FBD of sections:
5 unknowns!  

4 unknowns!

can use either section, but use the one with less unknowns.

using the right section:

\[ \Sigma M_b: \quad 3KJ + 6G_y = 0 \]
\[ KJ = -\frac{6G_y}{3} = -66.7 \text{ kN (c)} \]

take the moment about D:

\[ \Sigma M_k: \quad 8G_y - 2(40K) - 3CD = 0 \]
\[ CD = \frac{8G_y - 2(40K)}{3} = 62.1 \text{ kN (T)} \]

Sum forces in x or y

\[ \Sigma F_y: \quad G_y - 40K + \frac{3}{\sqrt{13}}KD = 0 \]
\[ KD = \frac{\sqrt{13}}{3}(40K - G_y) = 8.05 \text{ kN (T)} \]
Find the force in members ED, EH, and GH.

1. Draw FBD of sections
2. Draw FB of truss

The FBD of the sections

4 unknowns!

Use left section

Draw FBD of truss to solve for support!

Sum moments about A:

\[ 2M_A: \]
ΣM_A:
\[ 1.5(40k) + 3(30k) + 2(40k) - 4F_y = 0 \]

\[ F_y = \frac{1.5(40k) + 3(30k) + 2(40k)}{4} = 57.5 \text{ kN} \]

*Using the left section:*

*Take moment about E:*

ΣM_E:
\[ 1.5 \cdot GH - 2F_y = 0 \]

\[ GH = \frac{2F_y}{1.5} = 76.7 \text{ kN (T)} \]

*Take the moment about H:*

ΣM_H:
\[ 2(40k) - 4F_y - 1.5 \cdot ED = 0 \]

\[ ED = \frac{2(40k) - 4F_y}{1.5} = -100 \text{ kN (C)} \]

*Sum the forces in X or Y direction:*

ΣF_y:
\[ F_y - 40k - \frac{3}{5} \cdot EH = 0 \]

\[ \frac{2}{2} \]
\[ \frac{2}{3/2} = \frac{3}{5} \quad \frac{16}{4} + \frac{9}{4} = \sqrt{\frac{25}{4}} = \frac{5}{2} \]

\[ EH = \frac{5}{3}(F_y - 40K) = 29.2 \text{ KN (T)} \]