Structural Loads in Trusses
Method of Sections

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1.2.1 Method of Joints

$\boxed{\text{1.2.2 Method of Sections}}$

1.2.3 Method of Tension Coefficients

- In two dimensions (2D)
- In three dimensions (3D)

1.2.2 Method of Sections

- Based on the **same principles** and **assumptions** as before
- Especially useful for **slender** trusses – i.e. 'long and thin'
- Consists of **sectioning** the truss along a certain plane to expose **a maximum of three** internal forces
- Using the **three equilibrium equations** we can then determine these internal forces
- **Does not replace** the method of joints – in fact you still need the latter to find remaining internal forces

1.2.2 Method of Sections – 'Recipe'

KEY POINTS

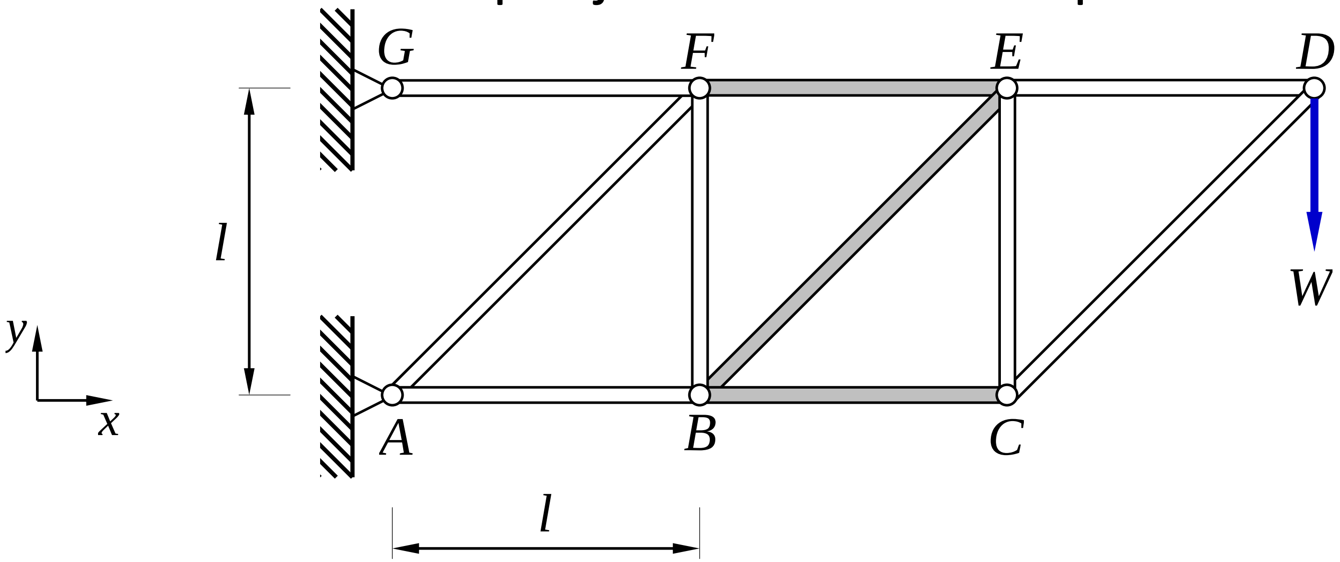
1. Calculate the degree of redundancy **before** finding unloaded members
2. Apply our **collinearity rules** to identify unloaded members
3. Create a **global FBD** for the entire structure
   - Draw positive reaction forces following the **external sign convention**
   - Write the **three** equilibrium equations: $\sum F_x = 0 \quad \sum F_y = 0 \quad \sum M = 0$
     - Find the reaction forces at supports

Exactly as before

4. 'Section' the truss to **expose internal forces** (maximum of 3)
   - Take one of the sectioned parts and treat it as an **independent truss**
   - Again, use the **three** equilibrium equations: $\sum F_x = 0 \quad \sum F_y = 0 \quad \sum M = 0$
     - Find the 'exposed' internal forces
5. If necessary, use the **method of joints** to find other internal forces!

Method of Sections - Example

- Consider the same pin-jointed truss example:



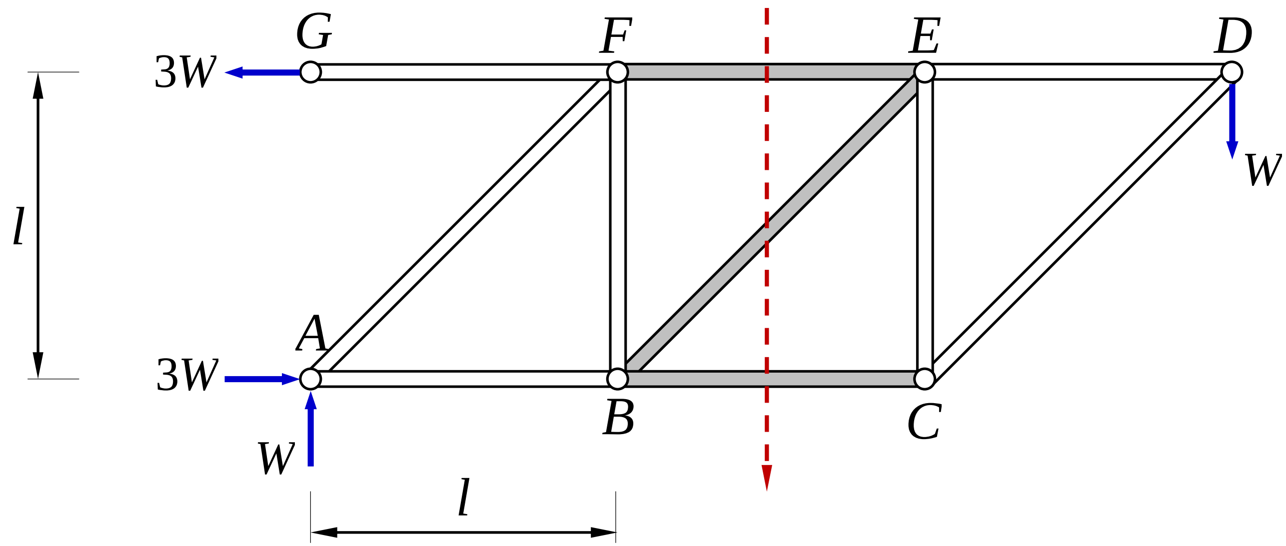
- Suppose we are only interested in members EF, BE and BC
- As seen earlier we apply the three global equilibrium equations to find the reactions:

$$\boxed{R_{Ax} = 3W} \qquad \boxed{R_{Gx} = -3W}$$

$$\boxed{R_{Ay} = W} \qquad \boxed{R_{Gy} = 0}$$

Method of Sections - Example

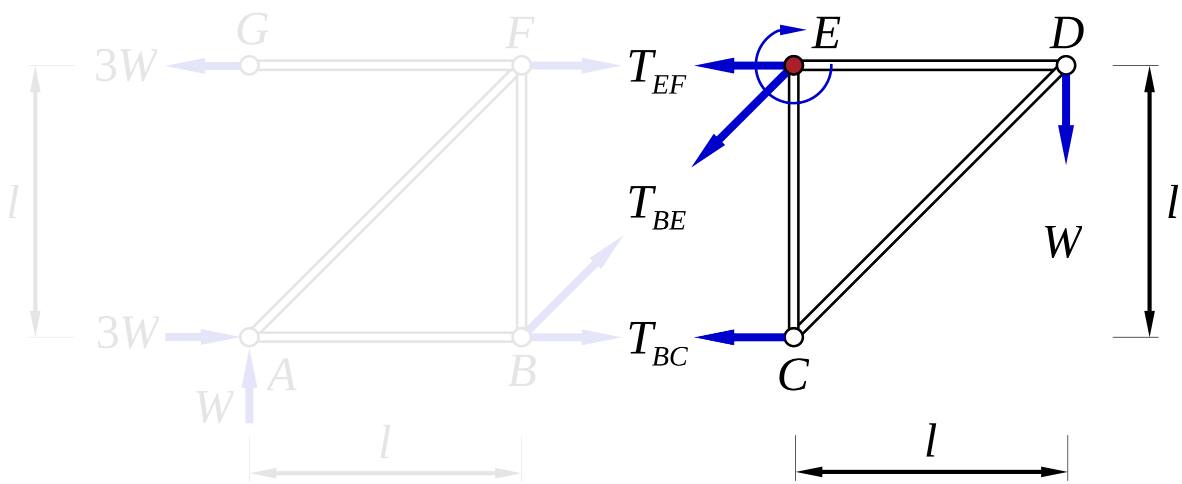
- Now all reactions and external forces are know:



- Suppose we are only interested in members EF, BE and BC

- By **sectioning** the truss along a vertical line we can 'expose' the three wanted internal forces

- The sectioned truss would look like this:



- Starting by the right-hand-side (RHS), the convenient pivot is joint E

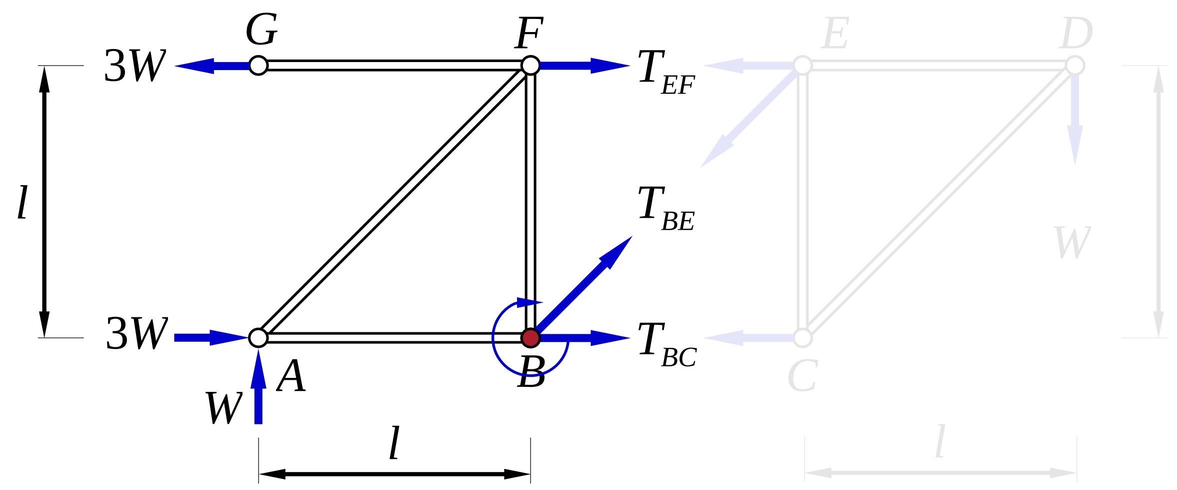
$$\sum M_{@E}^{\mathrm{CW}} = 0 \quad \therefore \quad W\left(l\right) + T_{BC}\left(l\right) = 0 \quad \therefore \quad \boxed{T_{BC} = -W}$$

- We can also analyse the vertical equilibrium of the entire RHS:

$$\sum F_y = 0 \quad \therefore \quad -W - T_{BE}\sin\theta = 0 \quad \therefore \quad \boxed{T_{BE} = -W\sqrt{2}}$$

Method of Sections

- Now the LHS. The convenient pivot for balancing the moments is joint B



$$\sum M^{\mathrm{CW}}_{@B} = 0 \quad \therefore \quad T_{EF}(l) + W(l) - 3W(l) = 0 \quad \therefore \quad \boxed{T_{EF} = 2W}$$

- We can also apply horizontal equilibrium to the entire LHS:

$$\sum F_x = 0 \quad \therefore \quad 3W - 3W + T_{EF} + T_{BC} + T_{BE}\cos\theta = 0 \quad \therefore \quad \boxed{T_{BC} = -W}$$

- The **remaining unknowns** are then obtained by the **method of joints**