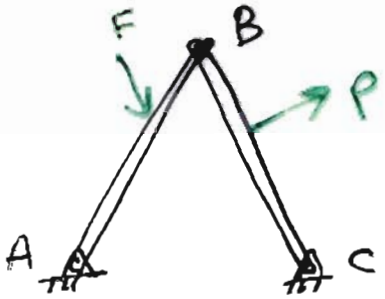
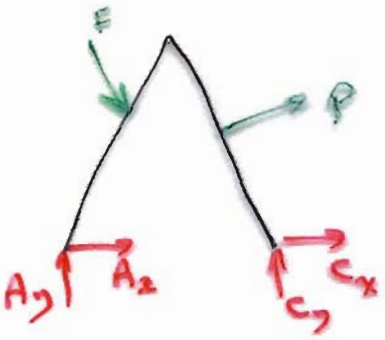
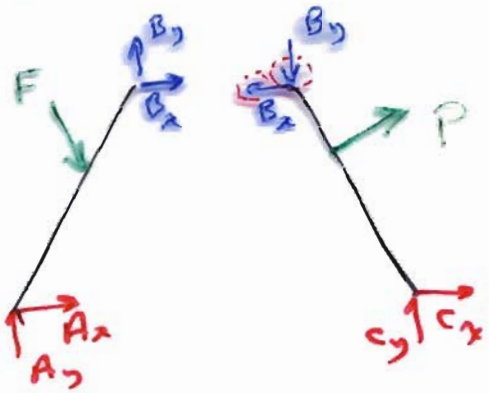
Structural Analysis





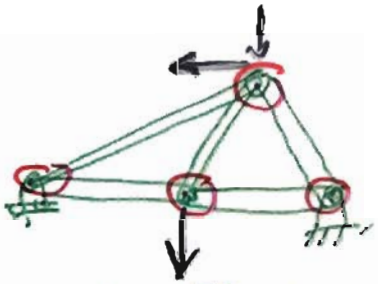


You may need to dismember ≡ disassemble ≡ separate or take the members apart in the structure.

By doing so, you can then analyze (ie., find the reactions, the internal forces, ... etc.) the structure.

* If a system / structure is in equilibrium, then any part of it must be in equilibrium.

Truss



① Straight members
② Connected at their extremities (ends) at joints.
③ Loads applied at joints only
④ Weights are neglected or assumed to be applied to the joints ($\frac{1}{2}w$ /joint).
⑤ Joints are smooth pins (thus no moment).

{ thus no member is continuous through a joint }

From the assumptions above, it can be concluded that all truss members are TWO-FORCE members which are under tension (T) { T ⟶ T } ≡ compression (C).

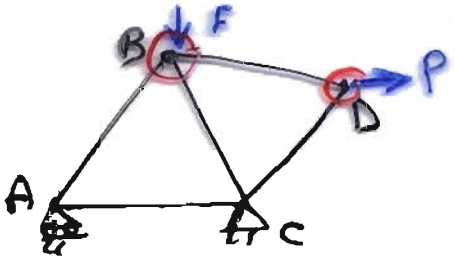
* Simple Truss

$m = 2n - 3$

m = # of members

.... etc.

Truss Analysis by the Method of Joints :



To <u>design</u> a truss, the <u>internal</u> forces in all members are needed.

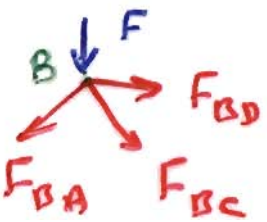
One way to find these forces is to write the equilibrium equations for each joint (particle).

$$\Sigma F_x = 0 \quad (1)$$

$$\Sigma F_y = 0 \quad (2)$$

2 → Particles ⇒

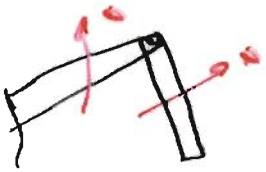
2 eq. ⇒ max 2 unknowns



The reactions may or may NOT be needed!

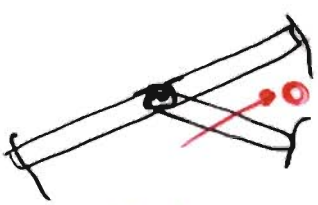
* Zero-Force Members

In some members, it may be possible to know that the member carries no force by inspection. These are called **zero-force members.**



- two members
- not in the same line
- no load on the joint

⇒ Both are zero-force members



- three members
- two on the same line and one inclined
- no load on the joint

⇒ The inclined member is zero-force

Think about special cases!!

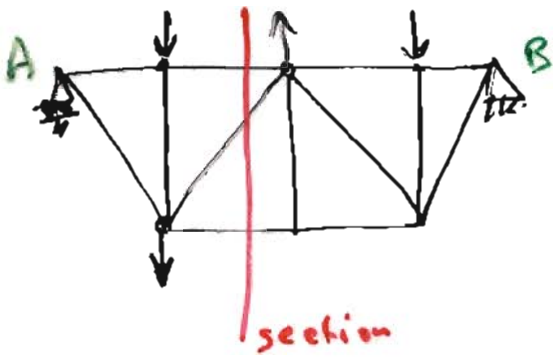
Analysis of Truss by the method of Sections

How? :

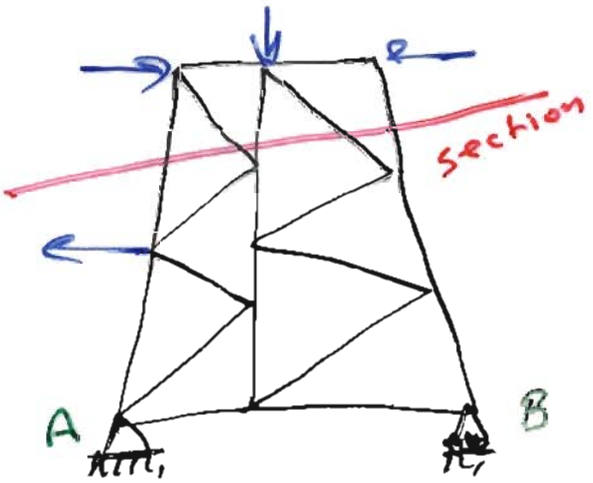
Pass a {section / cut} through the truss which intersects not more than 3 members, if possible; then 3 eq. & 3 unknowns can be solved for one of the two parts of the truss; it is a rigid body. ⇒

$\Sigma F_x = 0$ ①; $\Sigma F_y = 0$ ②; $\Sigma M = 0$ ③

This method is usually used when the force(s) in one or a few members is (are) desired.



Either of the reaction(s) at A & B is/are needed.



If the upper section is chosen, then no need to find the reactions at A and B.

If the lower portion is selected, then the reactions at A & B are needed.