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Analysis of Truss

Department of Civil Engineering

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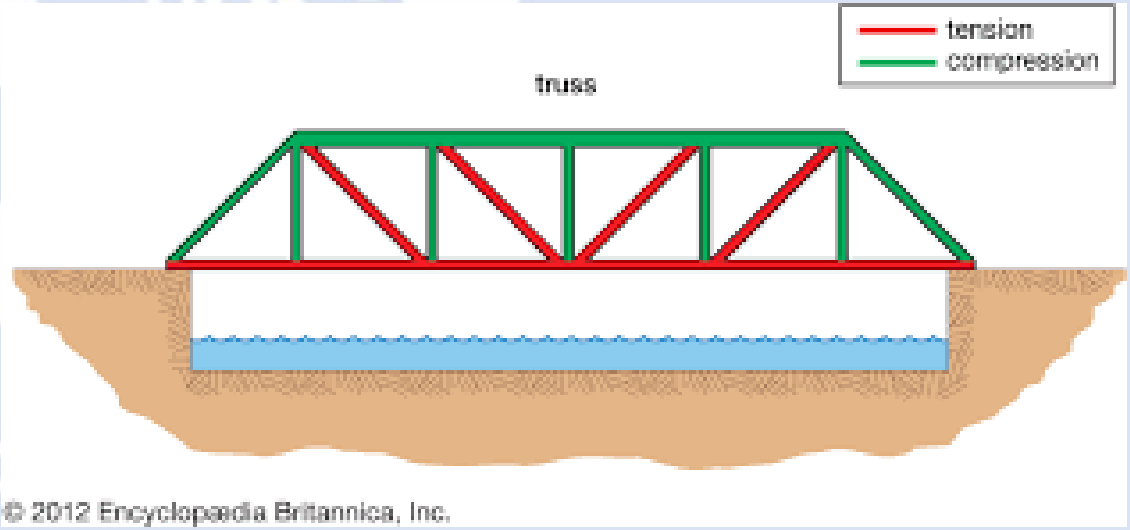
Introduction

Introduction

A **truss** is an assembly of beams or other elements that creates a rigid structure.

In engineering, a **truss** is a structure that "consists of two-force members only, where the members are organized so that the assemblage as a whole behaves as a single object".

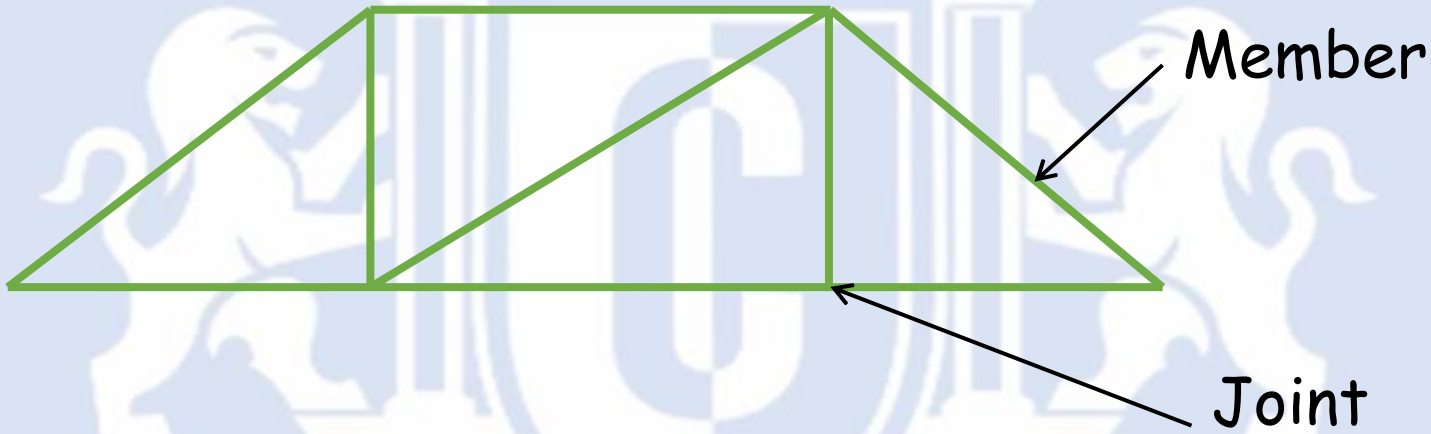


Static Determinacy

$$m = 2j - r$$

Where
m = No. of members
j = No. of joints
r = Equations of Equilibrium
= 3 ($\Sigma H=0$; $\Sigma V=0$; $\Sigma M=0$)

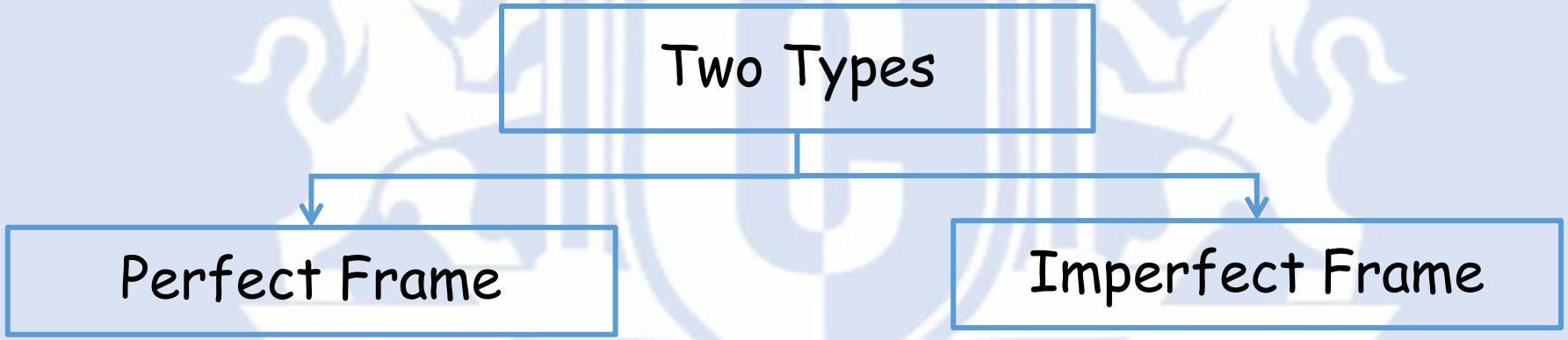
Static Determinacy



No. of members = m = 9;
No. of joints = j = 6;
r = 3

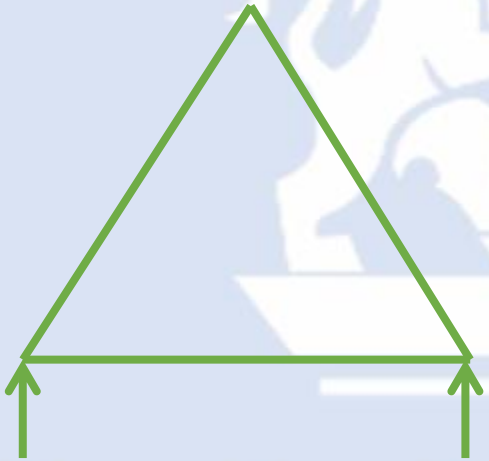
$m = 2j - r$
$9 = (2 \times 6) - 3$
$9 = 9$

Types of Trusses



Types of Trusses

Perfect Frame



A perfect frame is just made up of number of members just sufficient to keep it in equilibrium, when loaded, without any change in its shape.

OR

Perfect frames are Statically Determinate frames.
i.e., $m = 2j - r$

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Types of Trusses

Imperfect Frame

m = 4
j = 4

4 < {(2 x 4) - 3}
4 < 5

Deficient Frame

m < (2j - r)

m = 6
j = 4

6 > {(2 x 4) - 3}
6 > 5

Redundant Frame

m > (2j - r)

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Assumptions

There are five basic assumptions in the Analysis of trusses. They are

- The truss is a perfect frame.
- Trusses are connected together by frictionless pins.
- The truss structure is loaded only at the joints.
- The self weight of the members is negligible.
- The cross-sectional area of the members is uniform.

Methods of Analysis

Methods of Analysis of Truss

- Method of Joints
- Method of Sections
- Graphical Method

Analytical Methods

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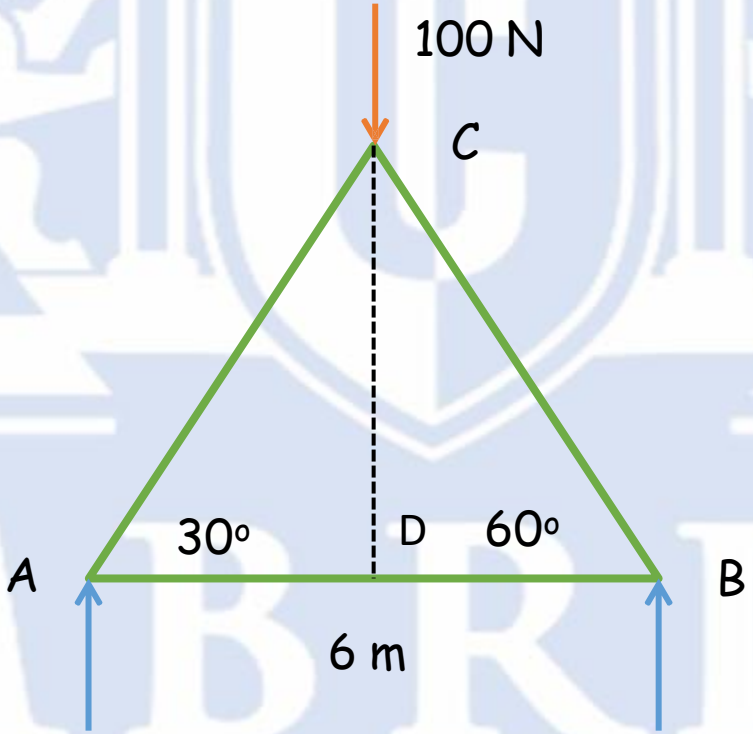
Method of Joints

Steps

1. A joint is selected such that not more than 2 unknown forces occur at that joint.
2. Each and every joint is considered a separate FBD.
3. Each joint will constitute a coplanar concurrent force system in equilibrium.
4. Apply the conditions of Equilibrium ($\Sigma H=0$; $\Sigma V=0$; $\Sigma M=0$).
5. Find the unknown force.

Method of Joints

Problem 1 : Find the forces in the members AB, BC and AC of the truss shown in the figure.



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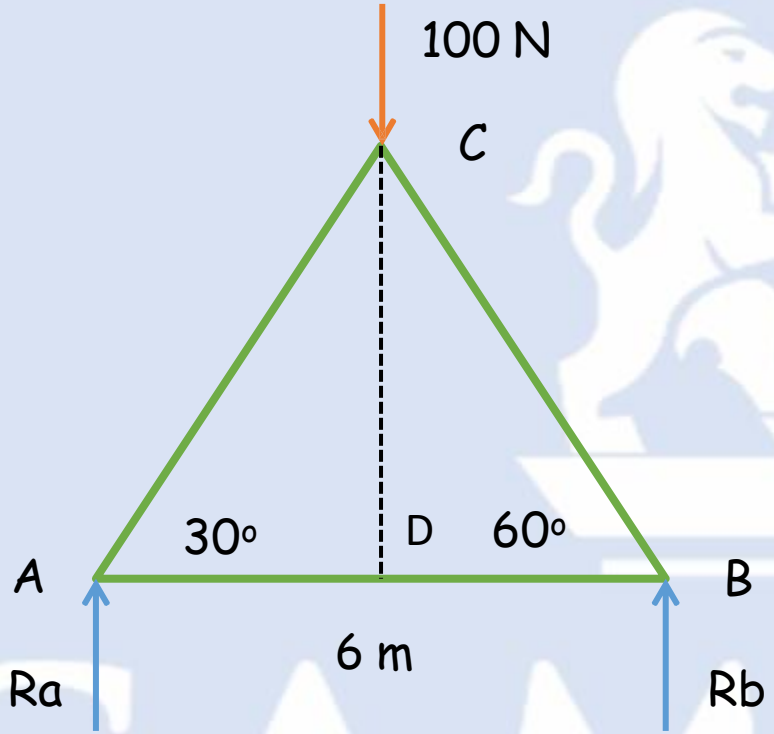
Method of Joints



AC = 5.2 m
BC = 3 m
CD = 2.6 m
AD = 4.5 m

To find support reactions

$\Sigma H = 0;$

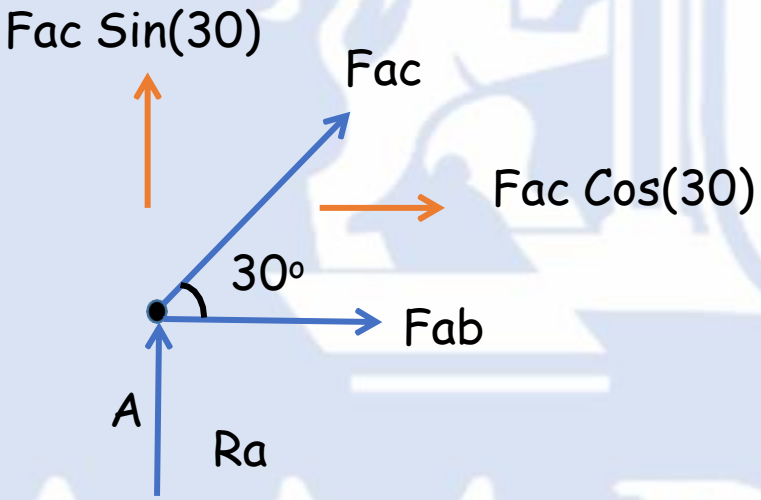
$\Sigma V = 0;$
$Ra + Rb = 100$ .....(1)

$\Sigma Ma = 0$
$(-Rb * 6) + (100 * 4.5) = 0$

Rb = 75 N
Ra = 25 N

Method of Joints

Let's consider **joint A**



FBD of joint A

$\Sigma H = 0$

$Fab + Fac\ Cos(30) = 0$ .....(1)

$\Sigma V = 0$

$Ra + Fac\ Sin(30) = 0$

$25 + Fac\ Sin(30) = 0$

$Fac = -50$ N (Compression)

$Fab = 43.24$ N (Tension)

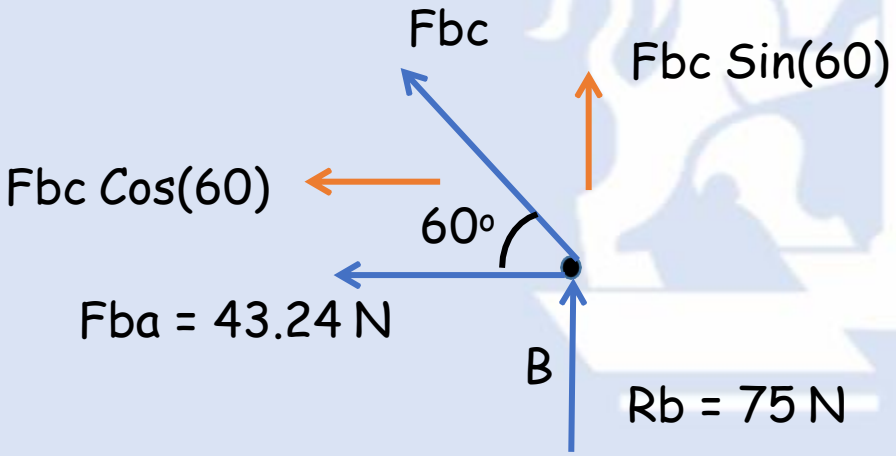
$Fab = Fba$

$Fac = Fca$

$Fbc = Fcb$

Method of Joints

Let's consider **joint B**



FBD of joint B

$\Sigma H = 0;$

$- Fba - Fbc \cos(60) = 0;$

$Fbc = 86.5\ N$ (Compression)

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THANK YOU