Theory of structure
Trusses
L5

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Trusses

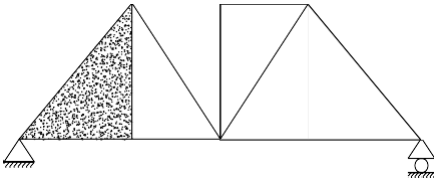
Trusses are used in bridges and ceilings with large spaces such as (factory ceilings, train stations, cinemas and Sports halls). Where they are in such cases are more economical than other construction systems.

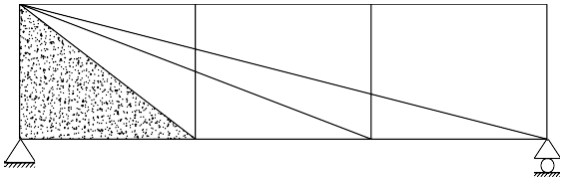
Types of statically determinate trusses

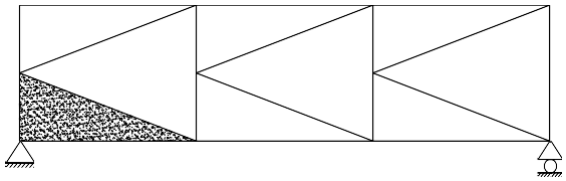
Where (b+r = 2j)

1- Simple trusses

Consists a base triangle (3 members meeting at 3 joints) and any additional 2 members meet at an additional joint.



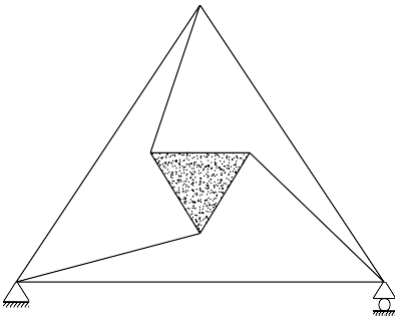


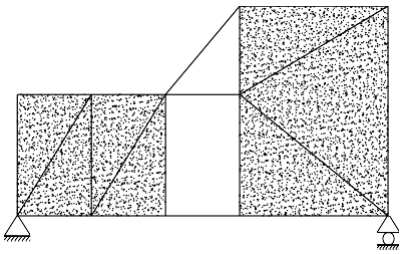


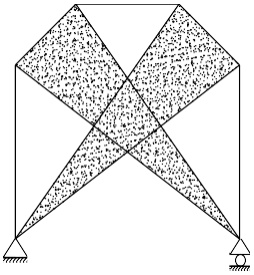
2- Compound trusses

Two or more simple trusses connected together by different means; such as

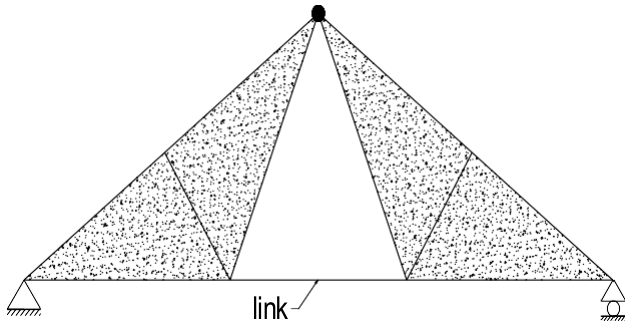
i- Three links: that is neither parallel nor concurrent.

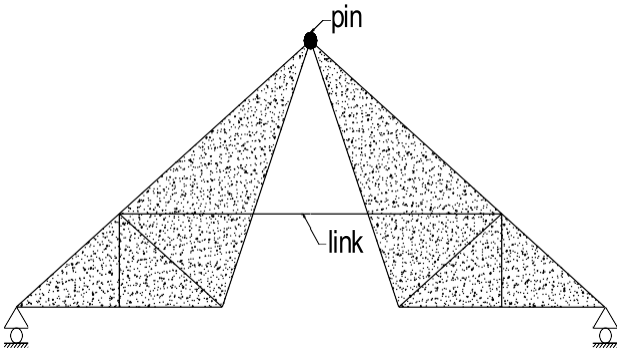




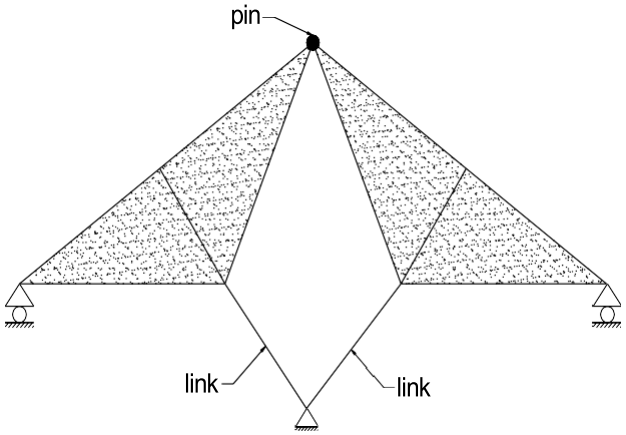


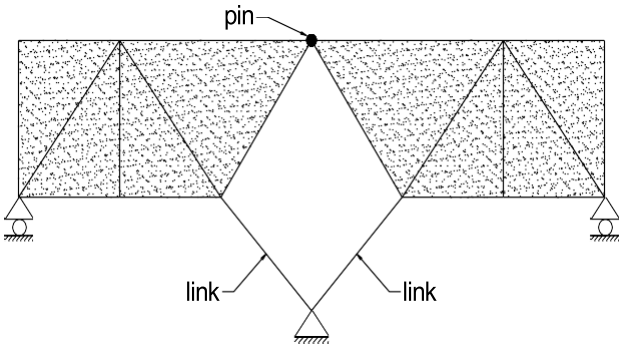
ii- A pin and link



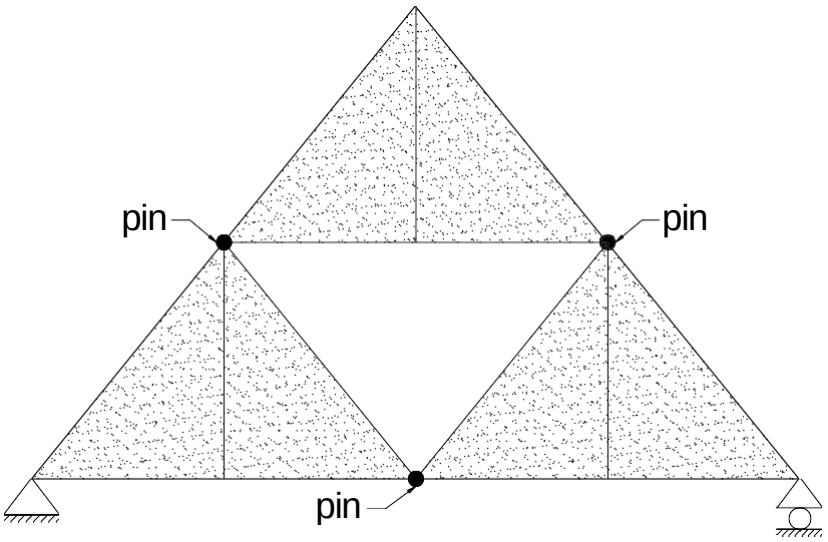


iii- A pin and two links intersecting at support



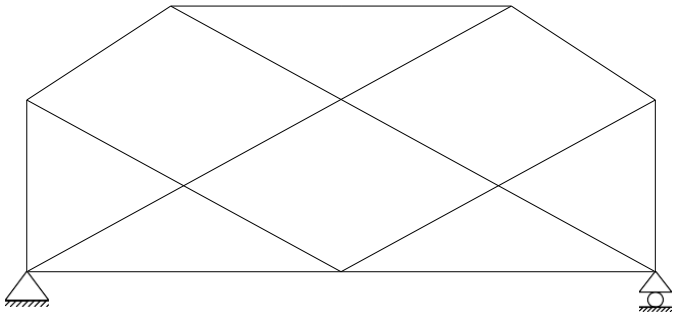


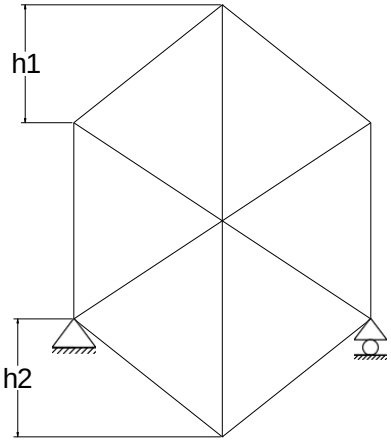
iv- Three pins



3-complex trusses

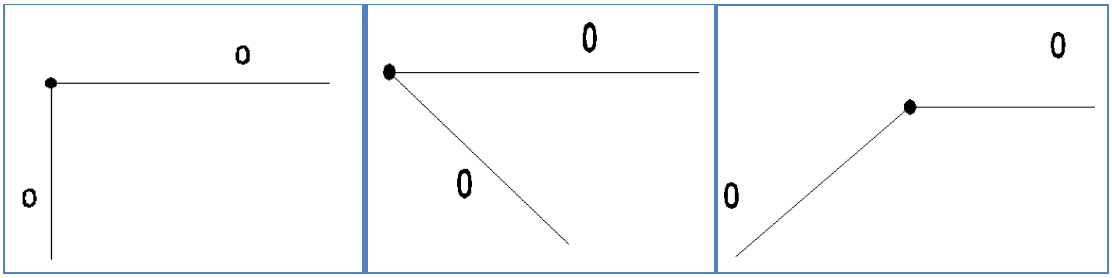
Each joint has at least 3 members. If a section is taken it will intersect so many members there force the truss cannot be easily (complex truss).



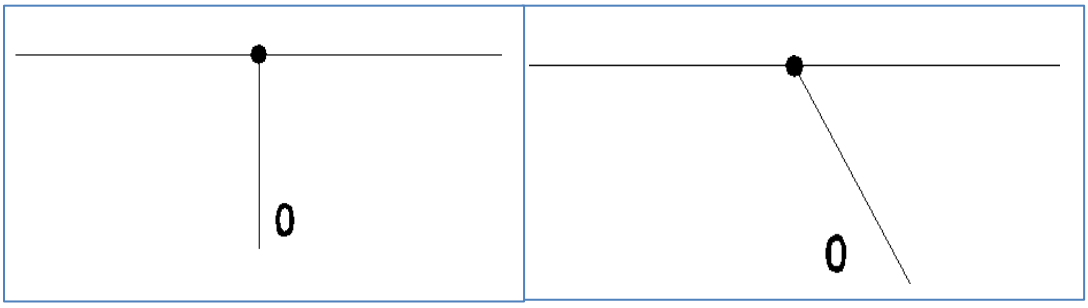


Important Notes:

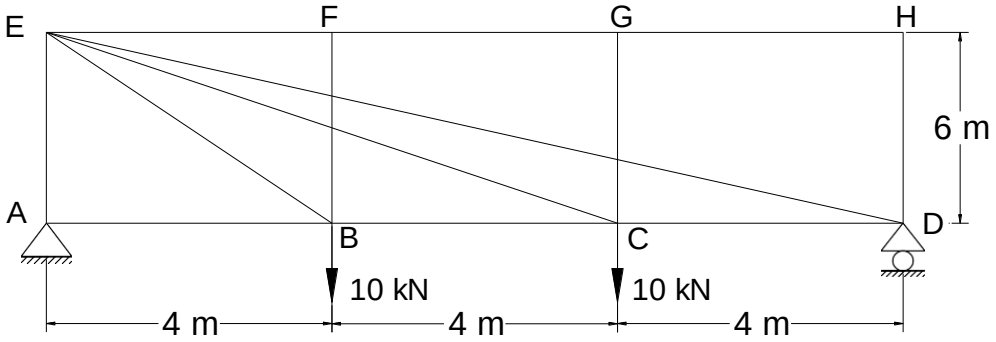
1- When met two bars in joint not on one straightness and there is no external force on this joint, we conclude that the force in both bars equal to zero.



2- When met three bars in joint two of them on one straightness and there is no external force on this joint, we conclude that the force in third bar equal to zero.



Ex1: for the simple truss shown in fig. find the axial force in bars CD, DE, CE & BE.



Solution:

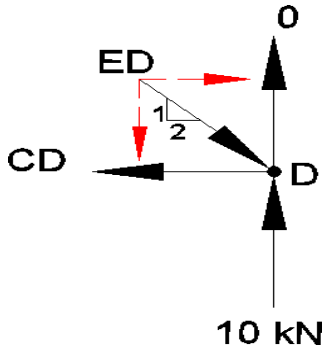
Due to symmetry of loading and distances

Dy= Ay = 10 kN ↑

Ax = 0

FB = GC = HD = HG = GF = FE = AB = 0

For CD & DE use joint D



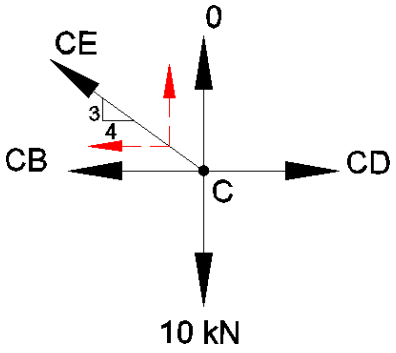
$\uparrow \sum f_y = 0$

$10 - ED * \frac{1}{\sqrt{5}} = 0 \Rightarrow ED = 10\sqrt{5}$ kN (Comp.)

$\rightarrow \sum f_x = 0$

$10\sqrt{5} * \frac{2}{\sqrt{5}} - CD = 0 \Rightarrow CD = 20$ kN (Ten.)

For CE use joint C



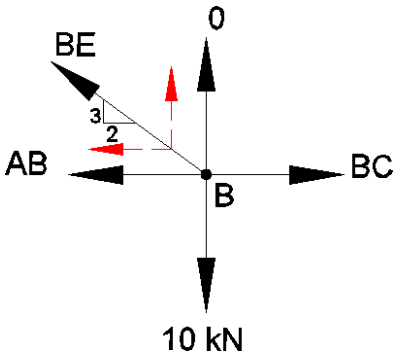
$\uparrow \sum f_y = 0$

$CE * \frac{3}{5} - 10 = 0 \Rightarrow CE = 16.67$ kN (Ten.)

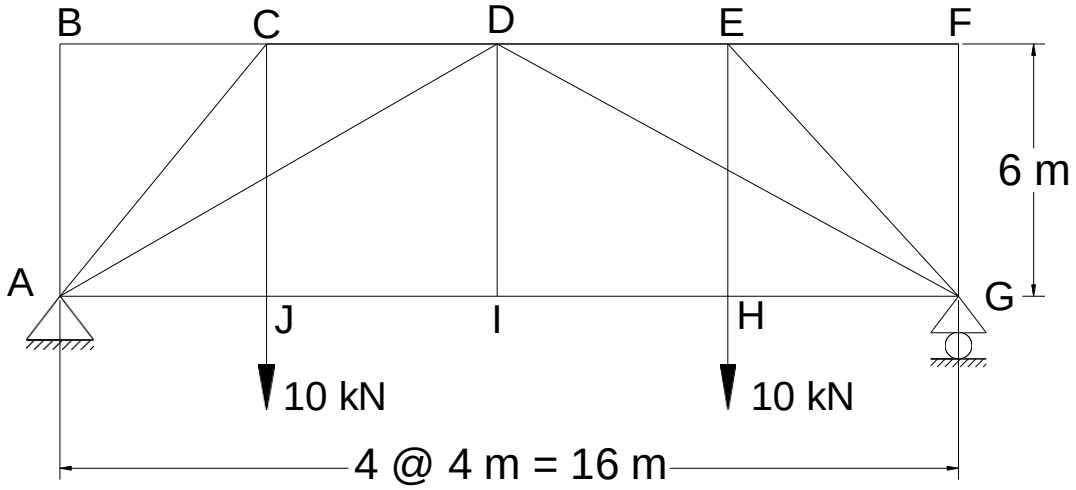
For BE use joint B

$\uparrow \sum f_y = 0$

$BE * \frac{3}{\sqrt{13}} - 10 = 0 \Rightarrow BE = 12\ kN\ (Ten.)$



Ex2: For the simple truss shown in fig. find the axial force in bars AC, AD & AJ.



Solution:

Due to symmetry of loading and distances

Ay= Gy = 10 kN ↑

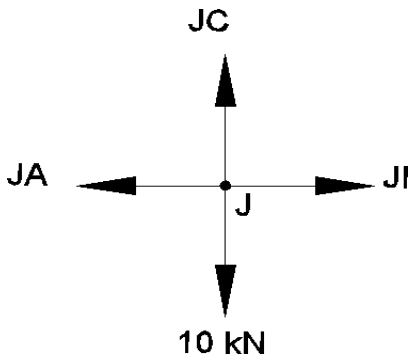
Ax = 0

BC, BA, FE, FG & DI = 0

Use joint J

$\uparrow \sum f_y = 0$

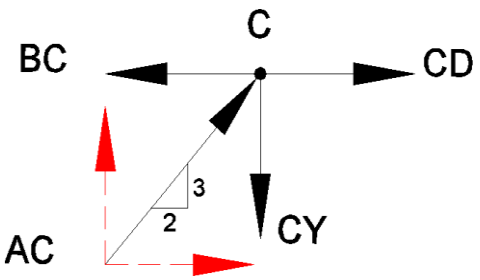
JC – 10 = 0 => JC = 10 kN (ten.)



Use joint C

$\uparrow \sum f_y = 0$

$AC * \frac{3}{\sqrt{13}} - 10 = 0 \Rightarrow AC = 12.018 \text{ kN (Comp.)}$



Use joint A

$\uparrow \sum f_y = 0$

$10 - AC * \frac{3}{\sqrt{13}} + AD * \frac{3}{5} = 0$

$10 - 12.018 * \frac{3}{\sqrt{13}} + AD * \frac{3}{5} = 0$

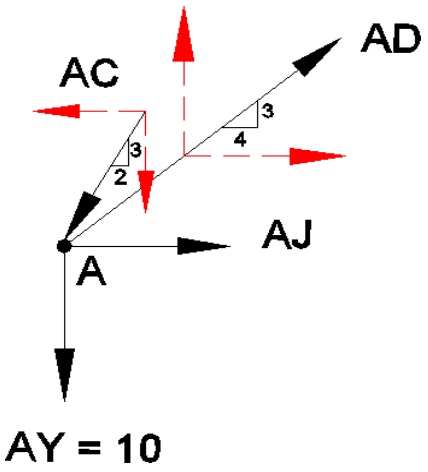
$AD = 0$

$\rightarrow \sum f_X = 0$

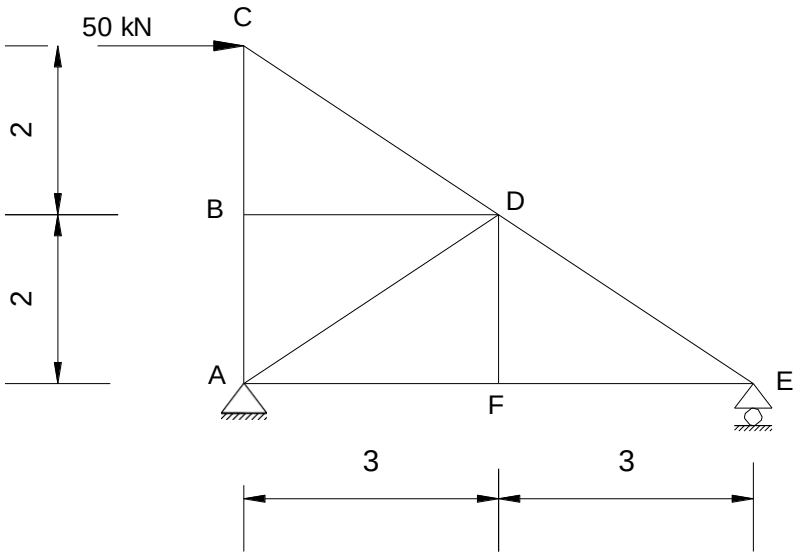
$AJ - AC * \frac{2}{\sqrt{13}} = 0$

$AJ - 12.018 * \frac{2}{\sqrt{13}} = 0$

$AJ = 6.67 \text{ kN (Ten.)}$



H.W1 :For the simple truss shown in fig. find the axial force in bars AB, AF,ED & CD.



H.W2 : For the simple truss shown in fig. find the axial force in bars AB, AF,AE, BC & CD.