Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 32:
Problems on Trusses

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Lecture Intended Learning Outcomes

At the end of this lecture, students will be able to:

- Define and recognise determinate trusses
- Calculate forces in the members of trusses by choosing and applying methods of sections or method of joints

Contents

Method of sections, problems for both method of joints and sections

Method of Section

- In the method of section, after determining the reactions, a section line is drawn passing through not more than three members in which forces are not known such that the frame is cut into two separate parts.

- Each part should be in equilibrium under the action of loads, reactions and forces in the members that are cut by the section line.

- Equilibrium of any one of these two parts is considered and the unknown forces in the members cut by the section line are determined.

Method of Section

- The system of forces acting on either part of truss constitutes a non-concurrent force system.
- Since there are only three independent equation of equilibrium, there should be only three unknown forces.
- Hence, in this method it is an essential condition that the section line should pass through not more than three members in which forces are not known and it should separate the frame into two parts
- Thus, the method of section is the application of non concurrent force system analysis

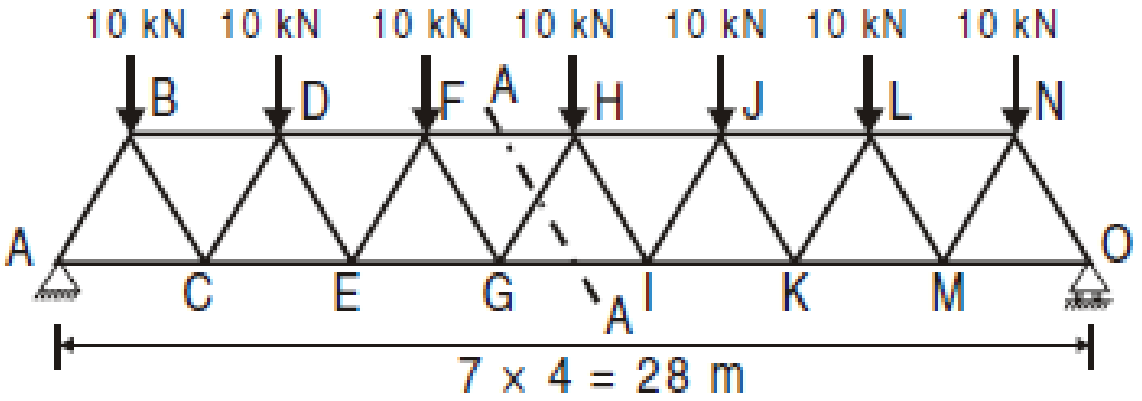
Method of Section

Under the following two conditions the method of section is preferred over the method of joints:

- In a large truss in which forces in only few members are required;
- In the situation where the method of joints fails to start/proceed with analysis.

Method of Section
Example Problem

Determine the forces in the members FH, HG and GI in the truss shown in Figure. Each load is 10 kN and all triangles are equilateral with sides 4m.

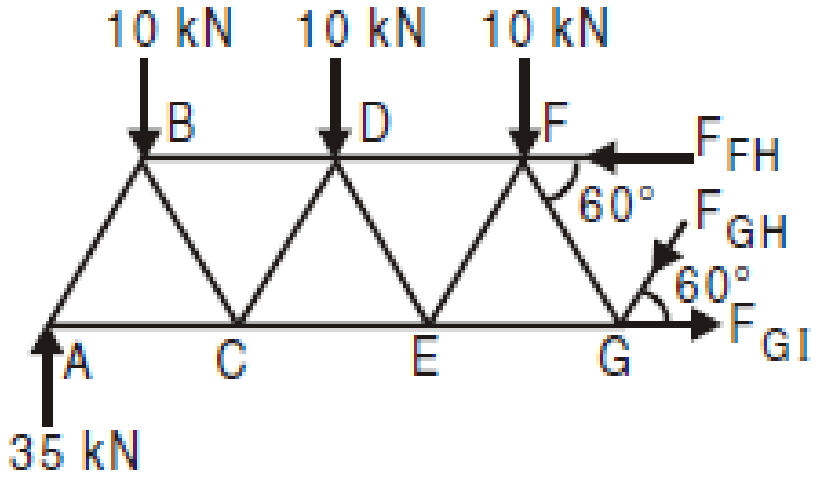


Method of Section
Example Problem

- Due to symmetry,

$$R_A = R_0 = \frac{1}{2} \times 10 \times 7 = 35 \text{ kN}$$

- Take section (*A*)–(*A*), which cuts the members *FH, GH* and *GI* and separates the truss into two parts.
- Consider the equilibrium of left hand side part as shown in Figure
- Prefer part in which number of forces are less



Method of Section

$\Sigma M_G = 0,$

$F_{FH} \times 4 \sin 60° - 35 \times 12 + 10 \times 10 + 10 \times 6 + 10 \times 2 = 0$

$\boldsymbol{F_{FH}}$ **= 69.2820 kN (Comp.)**

$\Sigma V = 0$, gives

$F_{GH} \sin 60° + 10 + 10 + 10 - 35 = 0$

$\boldsymbol{F_{GH}}$ **= 5.7735 kN (Comp.)**

$\Sigma H = 0,$

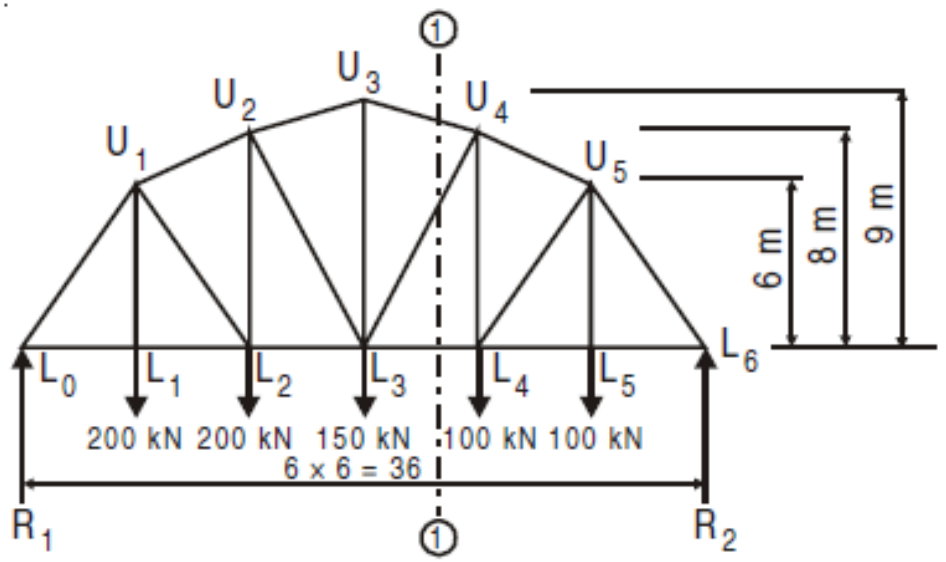
$F_{GI} - F_{FH} - F_{GH} \cos 60° = 0$

$\boldsymbol{F_{GI}} = 69.2820 + 5.7735 \cos 60°$

= 72.1688 kN (Tension)

Problems on Trusses

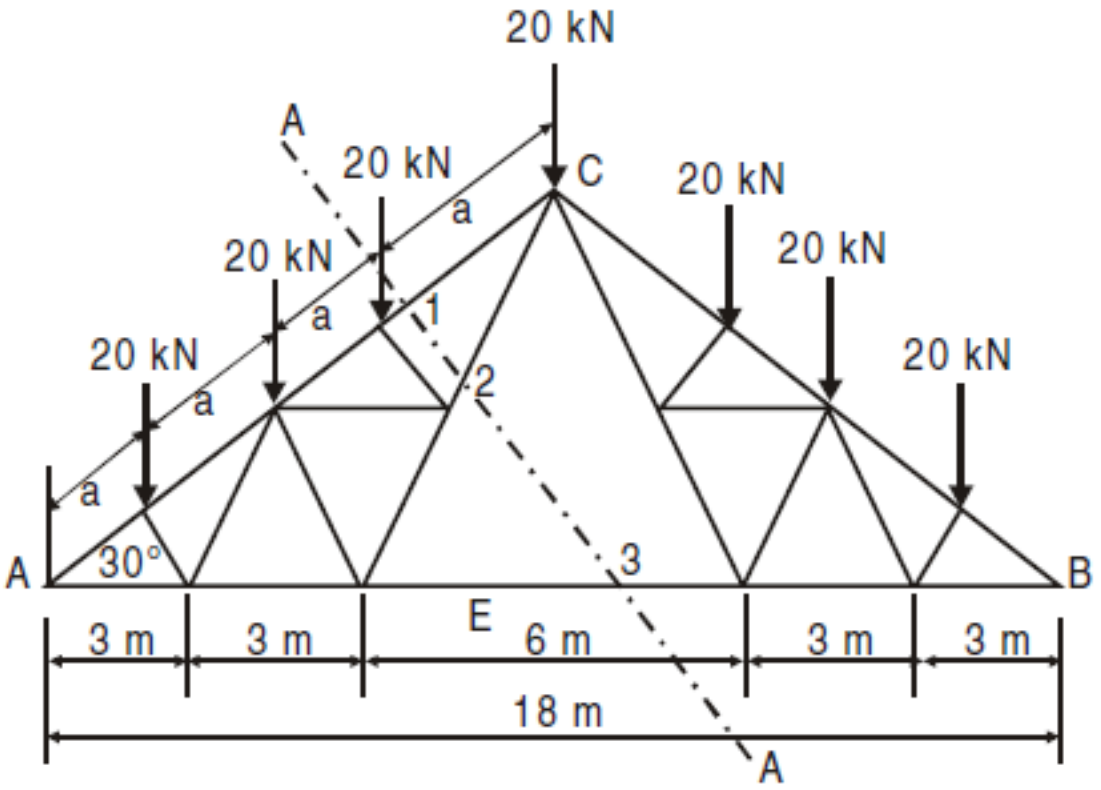
1.Find the magnitude and nature of the forces in the members U3U4, L3L4 and U4L3 of the loaded truss shown in Figure.



FL_3L_4= 412.5 kN (T)
FU_4U_3 = 456.2072 kN (C)
FU_4L_3= 62.5 kN (T)

Problems on Trusses

2.Find the forces in the members (1), (2) and (3) of French truss shown in Figure.



F_1 = 110 kN (C)
F_2 = 51.9615 kN (T)
F_3 = 69.2820 (T)

Summary

- The method of section is the application of non concurrent force system analysis

- The following two conditions indicate where the method of section is preferred over the method of joints:
  - Large truss in which forces in only few members are required
  - In the situation where the method of joints fails to start/proceed with analysis.