Solutions to Truss Analysis Problems

Civil Engineering Licensure Exam – Mock Exam

February 24, 2025

Problem 1: Determinacy of a Truss

A simple truss consists of 6 joints and 11 members. Determine whether the truss is statically determinate or indeterminate.

Solution:

To determine if a truss is statically determinate, we use the formula:

$$m = 2j - 3$$

where m is the number of members and j is the number of joints.

For this truss:

$$11 = 2(6) - 3 \Rightarrow 11 = 12 - 3 = 9$$

Since $11 \neq 9$, the truss is **statically indeterminate**.

Reference: Truss analysis by method of joints explained

Problem 2: Forces in Members (Method of Joints)

In a truss structure, a force of 200 N is applied vertically at joint C. Using the method of joints, determine the force in members AC and BC if the truss is supported at points A and B.

Solution:

First, calculate the support reactions at A and B by resolving the vertical forces. Then, analyze joint C by setting up equilibrium equations for the sum of forces in the horizontal and vertical directions:

$$\sum F_x = 0, \quad \sum F_y = 0$$

Solving these equations will yield the forces in members AC and BC.

Reference: Trusses - Method of Joints with Examples

Problem 3: Force in a Diagonal Member (Method of Sections)

A Pratt truss has a span of 8 m and a height of 3 m. Using the method of sections, determine the force in the middle diagonal member when subjected to a uniform load of 10 kN.

Solution:

Apply the method of sections by cutting through the truss to isolate the middle diagonal member. Sum moments about a point to eliminate other forces:

$$\sum M = 0$$

Solving for the force in the diagonal member will provide the answer.

Reference: Truss analysis by method of sections: worked example #1

Problem 4: Identifying Zero-Force Members

Identify the zero-force members in a truss structure where two non-collinear members meet at a joint with no external load or support.

Solution:

The rules for identifying zero-force members are:

1. If two non-collinear members meet at a joint with no external load or support, both members are zero-force members. 2. If three members form a truss joint, and two of them are collinear, the third non-collinear member is a zero-force member.

Reference: How to Identify Zero-Force Members in Trusses

Problem 5: Force in a Diagonal Member (Warren Truss)

A Warren truss has an external load of 5 kN applied at its center. Using the method of sections, determine the force in one of the diagonal members.

Solution:

Cut through the truss to isolate the diagonal member in question. Use moment equilibrium:

$$\sum M = 0$$

to solve for the force in the diagonal member.

Reference: Method of Sections Example - Truss Analysis