OBJECTIVE

To determine the internal force and normal/axial strain in truss members by using the concept of static equilibrium, stress-strain relation (Hooke's Law) and material properties of the truss system subjected to a given loading.

LEARNING OUTCOMES

At the end of this laboratory session, student should be able to:

1. To understand the behavior of truss system subjected to point/concentrated loading
2. To determine the internal forces for each member of the truss system by using joint or section method
3. Identify and specify whether the truss members in tension or compression through the analytical analysis and compare with the experimentally measured strains data.
4. Understanding of basic laboratory practice, including design of experiment, write a clear and well-presented technical report, data acquisition, interpretation and analysis and the relationship between experimental and theory.

THEORITICAL BACKGROUND

A truss is a structure composed of slender members joined together at their end joints. The members commonly used in construction consist of wooden or metal struts or bars. The end connections are usually formed by bolting or welding the ends of the members to a common plate called a gusset plate, as shown in Figure 1-b, or by simply passing a large bolt or pin through each of the members, Figure 1-b.

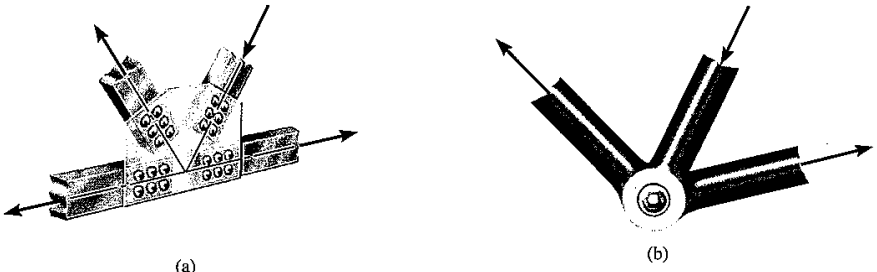

Figure 1 Internal forces truss

To design both the members and the connections of a truss, it is necessary to determine the force developed in each truss member when the truss system is subjected to a given loading. In this regard two important assumptions will be made:

a. All loadings are applied at the joints.
b. The truss members are joined together by smooth pins.

Because of the two assumptions, each truss member acts as a two-force member and therefore the forces at the ends of the member must be directed along the axis of the member. If the force tends to elongate the member, it is a tensile force (T), Figure 2(a), and if it tends to shorten the member, it is a compressive force (C), Figure 2(b).

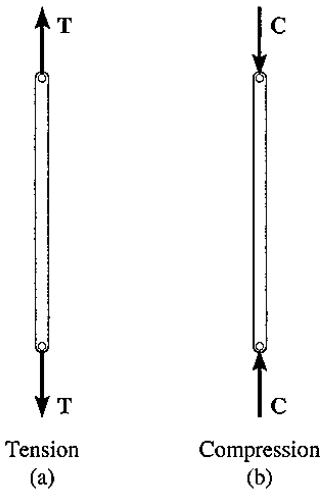

Figure 2 Tensile and compressive force in a bar

In static equilibrium the truss members will satisfy the following conditions:

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

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

$$\Sigma M = 0 \quad (3)$$

When material properties are used to determine force in truss member the following equation will be needed.

From Hooke's law : $\sigma = E\varepsilon$ (4)

where

σ = Stress in the member (N/m^2)
E = Young's modulus (N/m^2)
ε = Displayed axial strain produced in truss member

EQUIPMENT & SPECIMEN

1. Fixed base
2. Roller base
3. Steel bars with strain sensor (strain gauges)
4. Load controller
5. Measurement tools

Precaution! Ensure that you will not overload the given truss members as this will cause permanent deformation and may result in high errors of your experimental data.

TASK

1. Your experiment must be conducted to investigate and determine relationship between normal/axial strain and internal force for different applied loads.
2. All necessary data and results must be measured, recorded or tabulated systematically to facilitate its analysis and interpretation at the later stage of your work.

3. Comparison of experimentally determined results with the theoretical results must also be presented, analyzed and discussed in your report.

LAB REPORT

1. Title
2. Objective(s)
3. Introduction and Theory (Detail development and explanation of the underlying concept)
4. Apparatus
5. Procedures
6. Data and results
7. Analysis and discussion
8. Conclusion
9. References (Bibliography)