MEMORIAL UNIVERSITY OF NEWFOUNDLAND
FACULTY OF ENGINEERING AND APPLIED SCIENCE

Newfoundland & Labrador, Canada

Engineering: 5312 **Mechanics of Solids II**

Lab Test #4 – Simple Truss

OBJECTIVES:

1. To observe the behaviour of a simple truss subject to a symmetrical load.
2. To measure the deflections and strains in the truss
3. To compare the analytical and experimental results

TEST SPECIMENS

An instrumented truss -mounted in a test frame

EQUIPMENT

1. Structural testing frame for applying vertical loads at the middle of the truss bottom chord fitted with appropriate end supports, loading screw and load cell
2. Data acquisition unit
3. Dial gauge and/or Linear potentiometric displacement transducer (LPDT) for measuring displacements
4. Measuring instruments (callipers, etc.) as required

PROCEDURE

1. The set-up for this experiment is shown in Figure 1. Draw a sketch of the truss. Identify and lable all the members and joints.
2. Using the appropriate instruments, measure the dimensions of the truss and distance between the supports. Measure the length, cross-section properties (diameter, etc.) of all the members. Should you measure the member length from centre of joint or from the end of the member? Note the material properties of the members. Tabulate all the data. Which type of joints were used in the truss? Why should the joints in a truss be perfect

hinges (at least in theory)? How do the actual joints used in the truss specimen compare with perfect hinges? What will be the effect of 'not-so-perfect' hinges in the specimen? Is this a determinate truss? Why? Theoreticall, we would provide one support as a hinge and the other as a roller. Are the supports actually provided appropriate?

3. Make sure that the loading screw has sufficient 'travel' to apply the load. Do you notice any crookedness in the truss? Is this important? If not, when will it be important?
4. Check the data acquisition system, the personal computer and driving software. Familiarize yourself with their operation.
5. Set the initial values of load, axial displacement and lateral displacement to zero.
6. Load the truss (gently) in increments as explained by the TA or the Technician. After placing each load increment, allow the system to stabilize before logging the data.
7. Load until the displacement becomes noticeable or until instructed to stop. Do you think that you observed elastic deformation? Ideally, at what point would you stop loading? After reaching the maximum load, release the load in the same decrements as in the loading stage. Again log the deflections for each ***decrement***. Do you consider this as elastic deformation even after you unload the specimen?

Theoretical Derivations

1. Compute the cross-section area, etc., for each member. Using a bit of trigonometry, check if the measured lengths of members actually tally with the overall dimensions of the truss.
2. For a theoretical load of P at the middle of the bottom chord of the plane truss (not the 3D truss), derive the expressions for member forces. Use method of sections or method of joints. Can we use these methods for any type of plane truss (determinate or indeterminate)? Explain.
3. Derive the expression for deflection of the truss for a general load P as in the step above. You may use the energy method for this.

ANALYSIS

1. Convert the measured strains to stresses for each member at each load increment. Produce plots of measured vs. computed stresses for each member. Overlay this with

theoretical displacements. Comment on the comparisons. Note that the Load should always be on the vertical axis.

2. Produce plots of measured displacements vs. applied load. Overlay this with theoretical displacements. Comment on the comparisons.
3. Comment on the accuracy of using the manufacturer's recommended value of the Young's modulus. If you were to guess the Young's modulus from the experimental results, what would it be?
4. Prepare a report according to the given guidelines. Include all calculations made under "Preliminary Calculations" placed in an Appendix.

Note: Make all calculations (hand written or typed on a computer) legible and professional looking with sufficient margins, titles and good amount of "white space." The report must be produced the same way as you would a work term report. You may include photographs as well.

REFERENCE

R.C. Hibbeler "Mechanics of Materials," Prentice-Hall

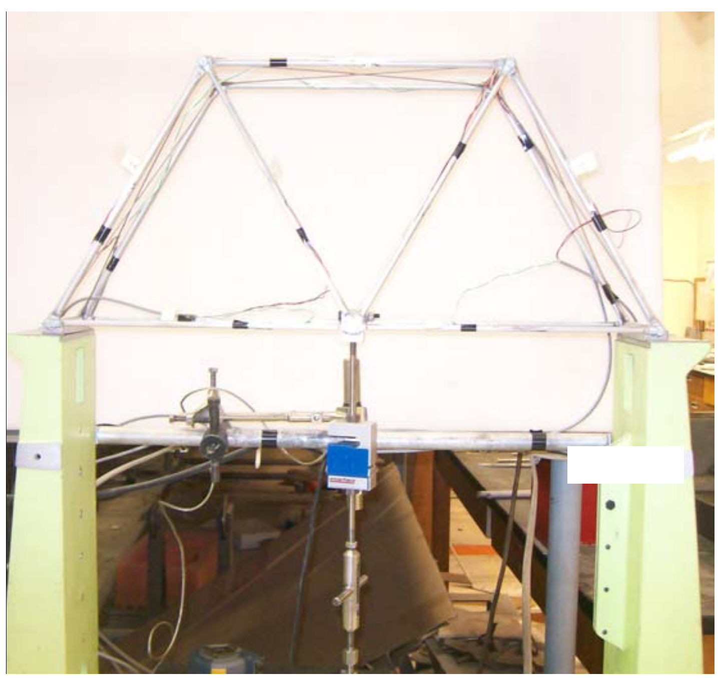

Figure 1 Truss test set-up