# ME 354 Lab 1 Beam Lab

This lab write-up will be a formal report on beams and strain gages. It is due one week from the date of your scheduled lab sessions. Refer to the class web page for the Formal format guidelines.

Assignment outline:

You are tasked to evaluate the designs of two different cross sectional beams for reactions forces, strains, and stresses. Both beams are of the same material (Aluminum 6061-T6). These beams are to be evaluated for a critical component of the landing gear of a large commercial airplane. This component is critical to the safety of many passengers so the stress distribution through the cross-section must be characterized in order to evaluate for a safe design. The loading configuration of these beams in operation is the same as the testing configuration of this lab (3 pt bending). You will use uniaxial, biaxial, and rosette strain gages with the Strain Smart data acquisition system.

Things you will measure/record during the lab:

1. Beam deflections
2. Reaction load (i.e. load at the load cell end)
3. Beam dimensions
4. Strain gage locations and orientations (don't forget to record the type of the strain gages)
5. Strain readings from the strain gages

Things you will need to calculate: (Place results in a table in the report. Place a table of intermediate calculations with an example of the steps for each calculation type in appendices),

1. Applied load and end reaction forces
2. Deflection at the applied load
3. Calculate the least-squares fit and R-squared value for applied load vs. measured deflection. Is the relationship linear?
4. Draw the moment and shear diagrams for each beam (don't draw by hand!)
5. Centroid of the beam's cross section
6. Moment of inertia for each beam
7. Calculate the theoretical stresses and strains at each strain gage
8. Calculate the percent different in measured strain and theoretical strain at each strain gage location.

Things you will want to discuss in your report:

1. When and in what general area will each beam fail?
2. Which beam is better, and why?
3. What other things can you infer/investigate that I missed/left out?

**Table 1.** Aluminum 6061-T6 Material Properties

| | |
|---|---|
| Elastic Modulus, E (MPa) | 69000 |
| Yield Strength (0.2%offset), $\sigma_o$ (MPa) | 275 |
| Poisson's ratio, $\nu$ | 0.33 |
| Ultimate Tensile Strength, $\sigma_u$ (MPa) | 324 |
| Percent Elongation, %el (50.8mm gage length) | 12 |