

**HOMWORK PROBLEM #2**  
*Data processing and error analysis*

The data from the lab testing from numerous specimens will be collected during the lab session which takes place in Rm. 112 Ketter Hall. The data will be provided to you “raw”. The data contains results of material testing: forces and displacements acquired in the lab experiments for characterization of material properties.

(In case of insufficient data from the live testing you may get alternative data from the website in the file BEAM.XLS and others with name of COLUMN or BEAM.

**Scope:**

Plot the stress-strain curve (use engineering stress and engineering strain) for their specimen and determine the following:

1. Modulus of elasticity
2. Proportional limit
3. Yield strength
4. Tensile strength
5. Ductility
6. Toughness
7. Resilience
8. Type and character of each fracture
9. Work to failure (energy stored)

Use the mechanical properties of the material to determine which material was tested. The definitions can be found in the supplemental material on the website (see address below).

**Required:**

- (a) Plot stress strain diagram of the data as given for one of the data files.
- (b) Smooth the data using the three points moving (average) window of uniform weight. Plot data again.
- (c) Repeat the smoothing of the initial data using a Gaussian weight. Plot data again
- (d) Repeat the above two requirements for a five-point window. Plot the results
- (e) Repeat the requirements in (b) and (c) for a seven-point window,
- (f) Plot results for all of the above
- (g) Calculate the max deviation in each window and for the whole data for both force and strains.
- (h) Determine the properties (list above) and the associated errors from the smoothen data.
- (i) Calculate the energy in the material up to end of test (i.e. the area below the loops).
- (j) Find the effect of smoothing on the energy dissipation and on the properties using the deviation information.
- (k) Establish a criterion for acceptable error

You can find the data on the website <http://civil.eng.buffalo.edu/cie616>