Analysis of Tensile Testing Data

Electronic Submission (PDF document) due on 4/19/19, 5:00PM -
Submit by uploading your file to your Canvas Assignments folder

Background

Tensile testing data is one of the most common types of experimental results that you will encounter when specifying materials for structural applications. You may not always have a chance to run the tests yourself- specimens are often sent to commercial testing labs or to a company's internal quality assurance lab. Consequently, you must be able to critically evaluate the quality of the data and analysis methods based on the raw data from the experiments. The key features of the testing and analysis methods are covered by ASTM E8 (https://www.astm.org/Standards/E8.htm) and E111 (https://compass.astm.org/EDIT/html_annot.cgi?E111+17). There may be associated standards that you review as you work through the project. *You have access to these standards free of charge*. You can download a PDF of the standards if you access them via a computer that is on GT network. Alternatively, you can log into the GT Library website and select ASTM Standards from the databases (GT has a subscription). Similarly, the ASM Metals Handbooks (also available through the GT Library databases) are a useful starting point for learning about metallic alloys. *In this project, groups of up five students will use raw data from a series of three experiments to determine tensile properties of the materials. As a group you will develop an analysis strategy for the data. Then each member of the group needs to write their own brief (~2 page) executive summary of the project results. The requirements for this document are detailed below.*

The Investigation

You have been given three sets of data from your testing laboratory that have been performed on the "same material with the same methods." Your task is to analyze the data and to critically evaluate their quality. When there are problems with the data quality, you will need to identify possible sources of error and ways to make things better in the future. The details of the materials, specimens, and testing parameters are in the summary file (file name: Group#-DataSummary.pdf). The raw data referred to in the summary file will be in the comma delimetered files names Group#Raw1.csv, Group#Raw2.csv, and Group#Raw3.csv.

When writing your project report, be sure to provide answers to the following key results and information:

- What are the expected chemistry and typical room temperature properties for your material
- Specimen dimensions and type
- Engineering stress strain curves
- Elastic moduli (choose your type carefully)
- Yield point
- Yield point elongation (if appropriate)
- Elongation
- Uniform elongation (if appropriate)
- Tensile strength
- Comparison of results to the literature

Reporting

Each of you will be responsible for submitting your own written executive summary report that will be about 2 pages (or less) text. Your results should be presented in the form of plots and tables that are appended to the end of your executive summary. These plots and tables do not count as part of the 2 page document. You may discuss your findings and interpretations with the other members of your group. The data, diagrams, and images for the

figures can be shared within your group. *However, you should write your own report.* Please be sure to cite the references that you use to help you interpret your findings. If you have any questions about the structure or other requirements of the project report, please be sure to ask.

Please prepare your document with word processing software of your choosing, but you must submit an electronic version of the report in a PDF format via the assignments tab on Canvas. If you have hand written notes or sketches that you would like to include, please be sure to scan append them to the PDF that you submit. Your report must have the following structure

- Introduction ***(A paragraph)***
  - What is your group number, and who were the other members?
  - What is your material, where did your data come from, and what were you asked to do?
  - What is the expected behavior for your material based on the literature?
- Experimental ***(About 1/2 page)***
  - Method (reference the standard so that you can be concise- but when there are choices you need to be clear about which ones you have made)
  - Equations used (cite the specific number in the standard when possible)
  - Results (elastic modulus, yield point, elongation, and fracture)
- Discussion ***(~1 page)***
  - Materials properties from each specimen
  - A comparison of your properties with literature and other specimens (citations!)
  - Not all of the data is of the same quality. Which data set (specimen) is the highest quality?
  - What are the possible sources of error in the lower quality data sets?
- Conclusions ***(1 paragraph)***
  - Recommendations for changes in testing protocols based on the issues that you identify.
- References
- Appendices (as may pages as needed, cited in order of appearance in the executive summary)
  - Plots of raw data
  - Plots of stress strain analysis
  - Plots, etc. related to the properties extracted from the stress strain curves

Please make sure that your results and discussion and conclusions explicitly answer the key questions noted above.

Paper Grading Rubric

Format (25%) Executive summary, references, and summary data should be present and readable. Data and concepts should be clearly presented in figures and tables. The most important feature of the format is that the experimental procedures and analysis methods must be sufficiently detailed to allow an evaluation of the accuracy of the work.

Materials Properties (50%) The data, its interpretation, and the answers to the key questions should receive equal weighting.

Conclusions/Recommendations (25%)