

# MANE 6962 Experimental Mechanics

# Report on Experimental Sessions

**Due: November 29, 2018**

Please analyze the data that you obtained in each experiment.

**Experiment 1) Measuring strain using markers.**

You will need:

1. a movie file of the specimen deformation during the experiment,
2. a data file including the force measurements and the time,
3. measurements of your specimen geometry,
4. a program called moviereader.m[[1]](#footnote-1),
5. MATLAB (and very likely Fiji[[2]](#footnote-2) and/or Ncorr[[3]](#footnote-3)) installed on your computer.

Please create stress-strain curves from the data that you have collected and discuss how you created them and your results for the different samples that you tested.

You have several options for extracting the uniaxial and transverse strain from the image data that you have captured. First, you will want to extract a reasonable number of frames to analyze from the movies using the moviereader.m program. Once you have created a gif file from that program, you may choose any method to collect position data from the (selected) glitter markers in the successive frames to calculate the strain at each time point. Here are a few suggestions: 1) In an image viewing software, manually collect the pixel position of selected glitter markers in each frame. 2) Use the Manual Tracking Plugin in Fiji (see provided pdf documentation) to write tables of position data and create movies of displacement tracks of the glitter markers. 3) For a deep dive, plot full-field strain heat maps using the digital image correlation open source software Ncorr (see the starter documentation file ‘Ncorr\_class instruction’).

In your report, discuss how you extracted the strain data and the limitations and possibilities of using fiducial markers to measure deformations.

**Experiment 2) Nanoindentation using the Atomic Force Microscope (AFM)**

In this experiment the NSG03 probe was used. You can find the ranges of the cantilever spring constant/stiffness and the tip geometry information on this website: http://www.ntmdt-tips.com/products/view/nsg03.

Sergey sent me 9 indentation files, some in csv and some in txt format (it appears they have the same data format in them. Please see the document ‘AFM Data.docx’ for some information on analyzing this data.

What elastic moduli do you get by fitting the indentation curves with a Hertz contact model? With other contact models? We talked about tip shape and the distribution of strain (you may also reference the Dimitriadis paper for this discussion) under sharp tips. Comment on the value of elastic modulus you obtained here and whether you think a spherical tip is necessary for the measurement, or if the sharp tip was sufficient.

1. Please refer to the document ‘Extracting frames using moviereader’ for instructions [↑](#footnote-ref-1)
2. Download Fiji at: https://imagej.net/Fiji/Downloads [↑](#footnote-ref-2)
3. Download Ncorr at: http://www.ncorr.com [↑](#footnote-ref-3)