MANE 6962 Experimental Mechanics
Experiments week, November 5 & 8, 2018

**Group 1**

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Monday, November 5th
AFM force curves

Thursday, November 8th
Full field strain tensile experiment

**Group 2**

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Full field strain tensile experiment

Thursday, November 8th
AFM force curves

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In both of these experiments you will be investigating the mechanical properties of polydimethylsiloxane (PDMS) an elastomer with an Si-O polymeric backbone. In class on Thursday, November 1 I showed you some tensile stress-strain curves for this elastomer when it is made in a 10:1 polymer to curing agent ratio. It displays non-linear elastic behavior, with strain stiffening due to the alignment of the polymeric backbone chains. In addition to the 10:1 PDMS, you will also be testing a 20:1 PDMS. Do you think the 20:1 will be softer or stiffer?

**Full-field tensile experiment (JEC 1219, 10am)**
Xiangyu Gong will be leading you through an experiment using the uniaxial load frames in JEC 1219. Please wear closed-toe shoes and observe all safety precautions that Xiangyu tells you about. Notably: keep your hands, arms, well all body parts (!), away from the load frame when the cross-head is moving; wear safety glasses when the cross-head is moving.

You will be measuring the stress-strain behavior of PDMS in tension. Since this material can experience very high strains, extensometers or strain gages are not appropriate for measuring the strain. One way this is done is with optical methods. A grid may be drawn or fiducial markers of some kind on the test specimen may be used to determine the deformation from images that are captured during the experiment with a camera. The strain may be determined as a function of time using the frame rate of the image capture.

PDMS, embedded with large glitter pieces, has been pre-fabricated for you in dog-bone specimen shape. What should you record before loading the sample into the test frame? (Take good lab notes!) Someone with space on his or her cell phone, please offer its use to video the experiment. Xiangyu will give you some pointers on aligning the cell phone camera and capturing an image to determine the scale.

The Bluehill software that runs the test procedures for the Instron machines will provide you with the load on the specimen as a function of time. The movie you've captured will provide you with full-field deformation data as a function of time. We intend to provide for you a MATLAB code that will extract frames from the movie and a much slower frame rate than the camera captures to make the data more tractable. I will provide more on the image analysis by the end of the week (please be well advised that

you are taking a course that is still under development by a spread-thin assistant professor! I do appreciate all of your constructive feedback for its future development.).

We only have one load frame that is set up to be able to do this experiment. But, hopefully you will have time to a few tests. Xiangyu will take you through this procedure. When the class time is over, make sure that you've made arrangements to obtain copies of the data so that you can analyze it.

**AFM force curves (CBIS, Floor 2 in front of elevators, 10am)**
Using the same material Dr. Sergey Pryshchep will demonstrate for you obtaining force curves using the AFM in CBIS. In your notes from Thursday's class (November 1), you should have the information on the steps that you will take in order to collect Force versus Indentation curves. Once the sessions are done, we will discuss further how to analyze the data that could be obtained. Please be sure to collect the data and any images from Sergey before you leave.