Project Milestone 4 Experimental Results

Gavin Haar, Zhen Xu, Liuhuan Zhang

Activity Report

✦

1 RESEARCH QUESTION

Our upgraded uniaxial tensiometer system improves system accuracy by using a reliable motor to stretch the material and implementing more advanced code. Additionally, our system improves the user's experience by interfacing through a phone app. To demonstrate these improvements, the system was tested on latex and nitrile material. The resulting data was compared to known values for each material.

2 EXPERIMENTAL RESULTS

To test each material, a stress strain curve was constructed using the distance and the force data collected. These graphs, included in figure 1 and figure 2, show the amount of stress on a material that causes it to stretch and eventually break. Numerous data points can be collected from these graphs, including young's modulus and ultimate tensile strength, which are included in table 1. Young's modulus is the slope of the curve in the initial linear region, and ultimate tensile strength is the maximum strain that a material can endure before breaking.

3 DATA ANALYSIS

As can be seen from these results, the system is a great improvement from our initial testing.

- *Gavin Haar. 12222,*
  E-mail: ghaar@albany.edu,
- *Zhen Xu. 12222,*
  E-mail: zxu7@albany.edu,
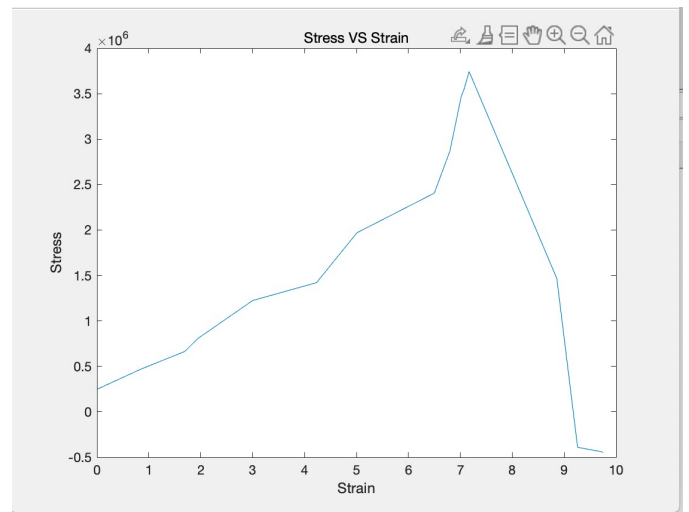 *Electrical & Computer Engineering, University at Albany.*

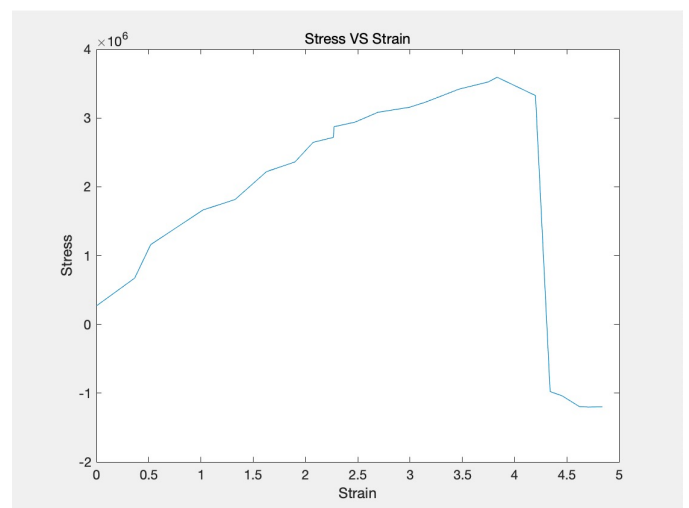Figure 1. Stress-strain curve derived from our system for Latex glove sample

Figure 2. Stress-strain curve derived from our system for nitrile glove sample

Metric	Sample	# Trials	Our System	Known Value	Error
Young's Modulus	Latex Glove	1	864 kPa	740 ± 10 kPa	16.8
..	Nitrile Glove	1	2.03 MPa	2.4 ± 0.2 MPa	15.3
Ultimate Tensile Strength	Latex Glove	1	3.74 MPa	3.3 ± 0.1 MPa	13.3
..	Nitrile Glove	1	3.80 MPa	4.4 ± 0.1 MPa	13.6

Table 1
Summary of experimental results

Now, the system is producing curves in the recognizable shape of a stress-strain curve with much improved accuracy. The code which we implemented offered a 'smoothing' effect on the curve and made up for error in the sensors which were used. Additionally, the phone app interface and installed motor definitely improved the ease of use. This is an aspect of the system which was very impressive and worked very well. The system could be improved further to get young's modulus and ultimate tensile strength within 10 percent of known values, however it is a vast improvement from the original system.