Uniaxial Tensiometer (Experimental Results)

Abdullah Qureshi, Jan Galia, Max Manier

Activity Report

1 Research Question

The primary goal of our improved uniaxial tensiometer system is to increase system accuracy by reducing friction in the system by using wooden linear rod track, and pulleys and crank system for uniform application of force. To demonstrate the accuracy of our system, we tested our system on two different types of material (latex and nitrile) and compared the values of Young's modulus and ultimate tensile strength computed from the stress-strain curve to known values for these materials

2 Experimental Results

1) Stress-strain curve for latex glove (See Figure 1).
2) Stress-strain curve for nirile glove (See Figure 2).
3) Table summarizing key metrics (See Table 2).

The referenced graph shows how material is stretched when pressure is applied on the material. The referenced table show the calculated Young's Modulus and Ultimate Tensile Strength values. Young's Modulus is the slope of the linear region of the graph. Ultimate Tensile Strength is the maximum value of stress the material can withstand before breaking.

- *Abdullah Qureshi. 12222,*
  E-mail: aqureshi@albany.edu,
- *Max Manier. 12222,*
  E-mail: mmanier@albany.edu,
  Electrical & Computer Engineering, University at Albany.

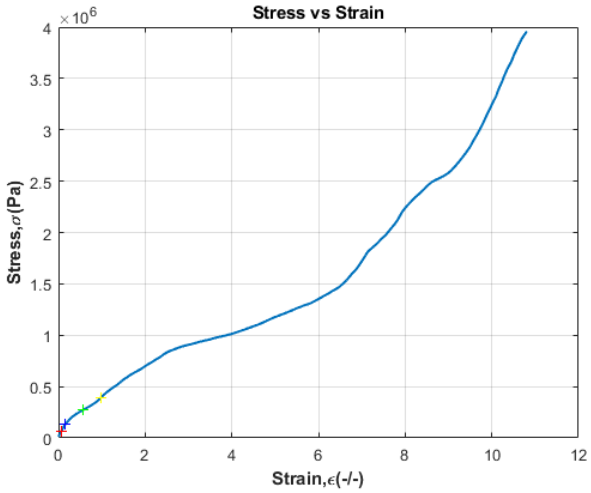

Figure 1. Stress-strain curve derived from our system for Latex glove sample

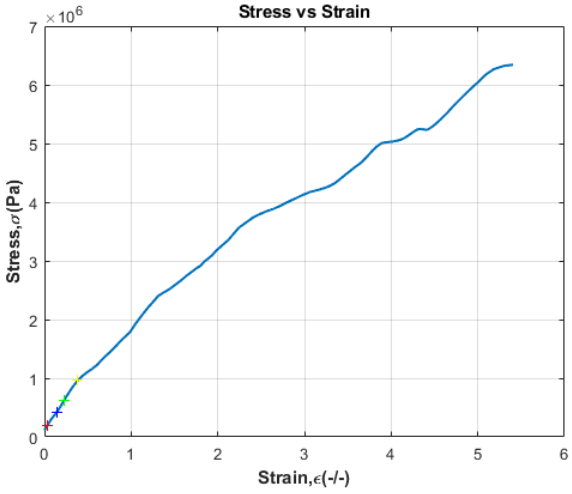

Figure 2. Stress-strain curve derived from our system for nitrile glove sample

Metric	Sample	# Trials	Our System	Known Value	Error
Young's Modulus	Latex Glove	1	604 ± 10 kPa	740 ± 10 kPa	18.3
..	Nitrile Glove	1	1.6 ± 0.2 MPa	2.4 ± 0.2 MPa	33.3
Ultimate Tensile Strength	Latex Glove	1	3.5 ± 0.1 MPa	3.3 ± 0.1 MPa	6.06
..	Nitrile Glove	1	3.8 ± 0.1 MPa	4.4 ± 0.1 MPa	13.6

Table 1
Summary of experimental results from multiple trials

Metric	Sample	# Trials	Our System	Known Value	Error
Young's Modulus	Latex	2	632 ± 10 kPa	740 ± 10 kPa	14.6
..	Nitrile	2	1.92 ± 0.2 MPa	2.4 ± 0.2 MPa	20
Ult. Tensile Strength	Latex	2	3.1 ± 0.1 MPa	3.3 ± 0.1 MPa	6.06
..	Nitrile	2	4.0 ± 0.1 MPa	4.4 ± 0.1 MPa	9.09

Table 2
Summary of experimental results from multiple trials

3 Data Analysis

As we can see from the results the difference between the observed and theoretical Young's Modulus and Ultimate Tensile Strength is not that large. This indicates that our current system is very accurate. Similarly, when different trials were done the key metrics were overall consistent, thus indicating that our current system is reliable as well. One of the best practices in building an accurate and reliable tensiometer is to use a load cell and range sensor which is more accurate and which does not through random values while being tested.