Uni-Axial Automated Tensile System

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Problem Statement

- The University at Albany's chemistry department, as part of their educational mission, intends to build a laboratory for undergraduate students where they can gain hands on experience testing various material properties (including tensile strength). However, due to the extremely high cost of commercial products they have been unable to equip such a laboratory.

- The goal of this project is to build an accurate, low cost, easy to use uniaxial tensile strength tester to support this educational mission.

System Requirements

- **System Accuracy:** The system should be able to accurately measure the stress-strain curve, such that Young's Modulus and Ultimate Tensile Strength can be calculated to within two significant figures.

- **System Ease-of-Use:** The system should be easy to calibrate and operate by undergraduate students without requiring knowledge of electronics or software programming.

System Enhancement Budget

Part	Purpose	Cost
50kg Load Cell	Measures Force	$50
Actuator System	Provides uniaxial force	$60
LCD, Keypad, SD	For stand-alone system	$30
Clamp Hardware	Combine 3-D printed parts	$10
	TOTAL	$150

Project Partners

- Special thanks for Professor Chen, Feldblyun, Yeung, and the University at Albany's Chemistry Department for sponsoring this project.
- This project was developed in ECE442: *Systems Analysis & Design* in the Electrical & Computer Engineering Department.

Signature

Team 6

Experimental Results

System Accuracy

Metric	Sample	Our System	Known Value
Young's Modulus	Latex	770 ± 30 kPa	740 ± 10 kPa
…	Nitrile	2.4 ± 0.2 MPa	2.4 ± 0.2 MPa
Ult. Tensile Strength	Latex	2.7 ± 0.3 MPa	3.3 ± 0.1 MPa
…	Nitrile	4.4 ± 0.4 MPa	4.4 ± 0.1 MPa

Initial vs. Current Stress/Strain Curves

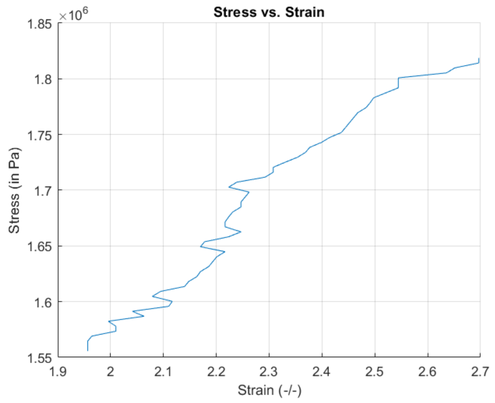


Figure 1: Original system data. The plot is filled with erroneous content.

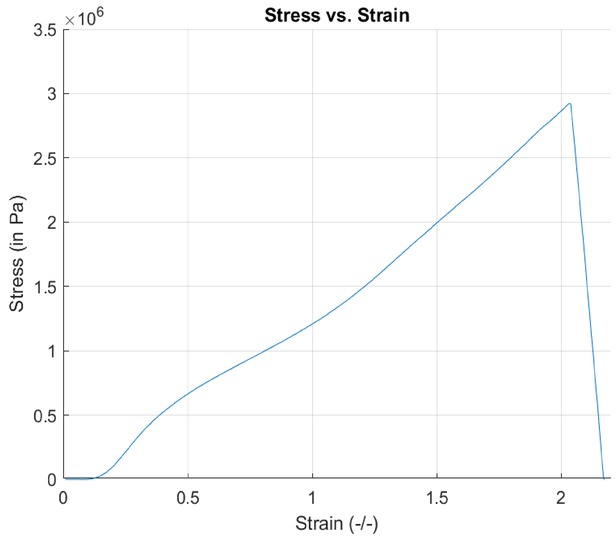


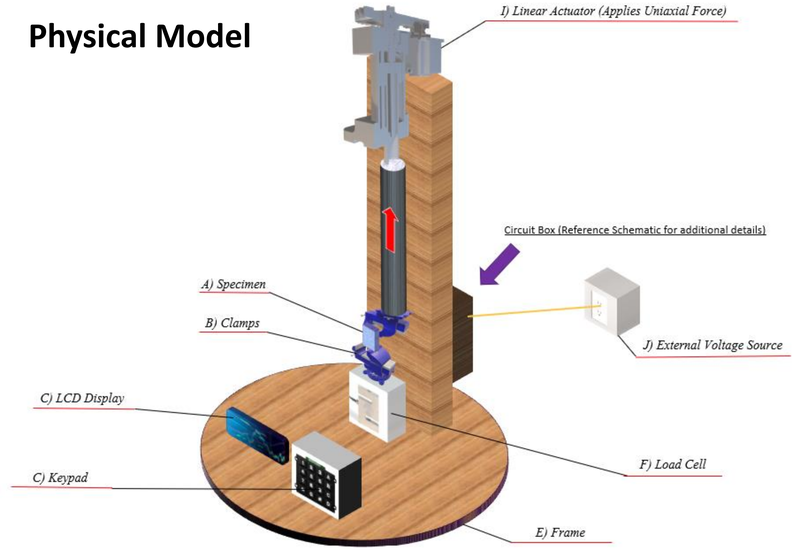
Figure 2: Data collected from improved system (current implementation). The plot is significantly improved, highlighting the importance of a drive system that applies uniform force.

System Design

Key System Features

- **Uniaxial Drive System** - Composed of a L298N DC Motor Driver Module and an Eco-Worthy 300mm Stroke Linear Actuator. Eliminates the risk of erroneous data due to friction.
- **Stand-Alone Apparatus -** The incorporation of an LCD screen, keypad, SD card capability and wall plug functionality allows for an independent system. Users can communicate with the device without any added software, thereby emphasizing the practicality of the device.

Physical Model



Circuit Schematic