IZOD Impact Resistance Test Apparatus

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Introduction

- Pendulum style impact testing is used to measure a materials toughness
- Toughness is a factor of a materials ability to absorb energy with out fracturing
- Fracture toughness is one of the more important material properties for design applications

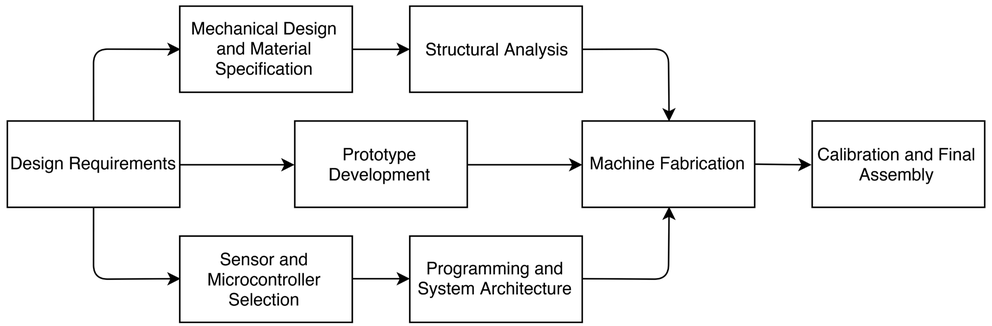
Project Deliverables

- Design and fabricate pendulum style impact testing apparatus
- Sensor setup to measure the initial and final heights of the impactor head
- Software component to interact with the sensor and capture data
- Adherence to ASTM and OSHA guidelines and standards

Design Team Input

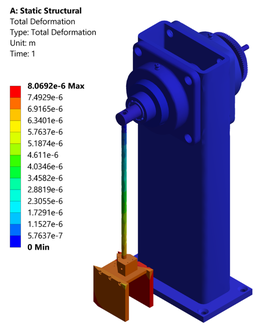
- Semi-Automated the system by adding a DC motor to control pendulum arm motion
- Used an electromagnet to control the release of the pendulum arm. This will decouple the pendulum from the motor allowing for unrestricted motion and negating any potential energy loss.
- Installed additional sensor to measure and record pendulum acceleration
- Installed touch screen control system

Design Process



Structural Analysis

- ANSYS 2018 used to measure deflection in the structural members
- G-Force simulated by applying a force normal to the bottom of the weighted side plates

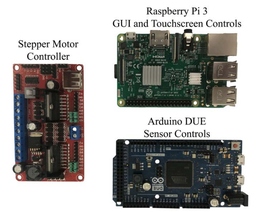


Prototype

- 3D Printed a scaled down model to simulate the IZOD test apparatus motion
- Incorporated the encoder, microcontroller and MEMS accelerometer
- Allowed the team to validate the program architecture through testing

Control System

- Arduino Due Board: Microcontroller for apparatus control and data collection
- Motor Control Board: Supplies power to operate Stepper Motor and Electromagnet
- Raspberry Pi: Runs program and translates sensor output into useable data



Apparatus Operation

- Initial start up will require operator to *Calibrate* starting position
- Operator will select the *Loading* option. Moving the pendulum and allowing access to load next test specimen.
- After specimen loading, operator selects the *Run* option.
- Stepper Motor raises pendulum to the ASTM required height and the Arduino will record position measured by the encoder.
- Electromagnet is de-energized allowing the pendulum to fall and impact the test specimen.
- Specimen fractures and pendulum will swing to a final height.
- Arduino captures final height from the encoder and pendulum acceleration through the fracture of the specimen.
- Raspberry Pi will translate the data into Impact Energy and Fracture Toughness, displaying it on the screen and saving a text file of all the data.