# Soft Robots

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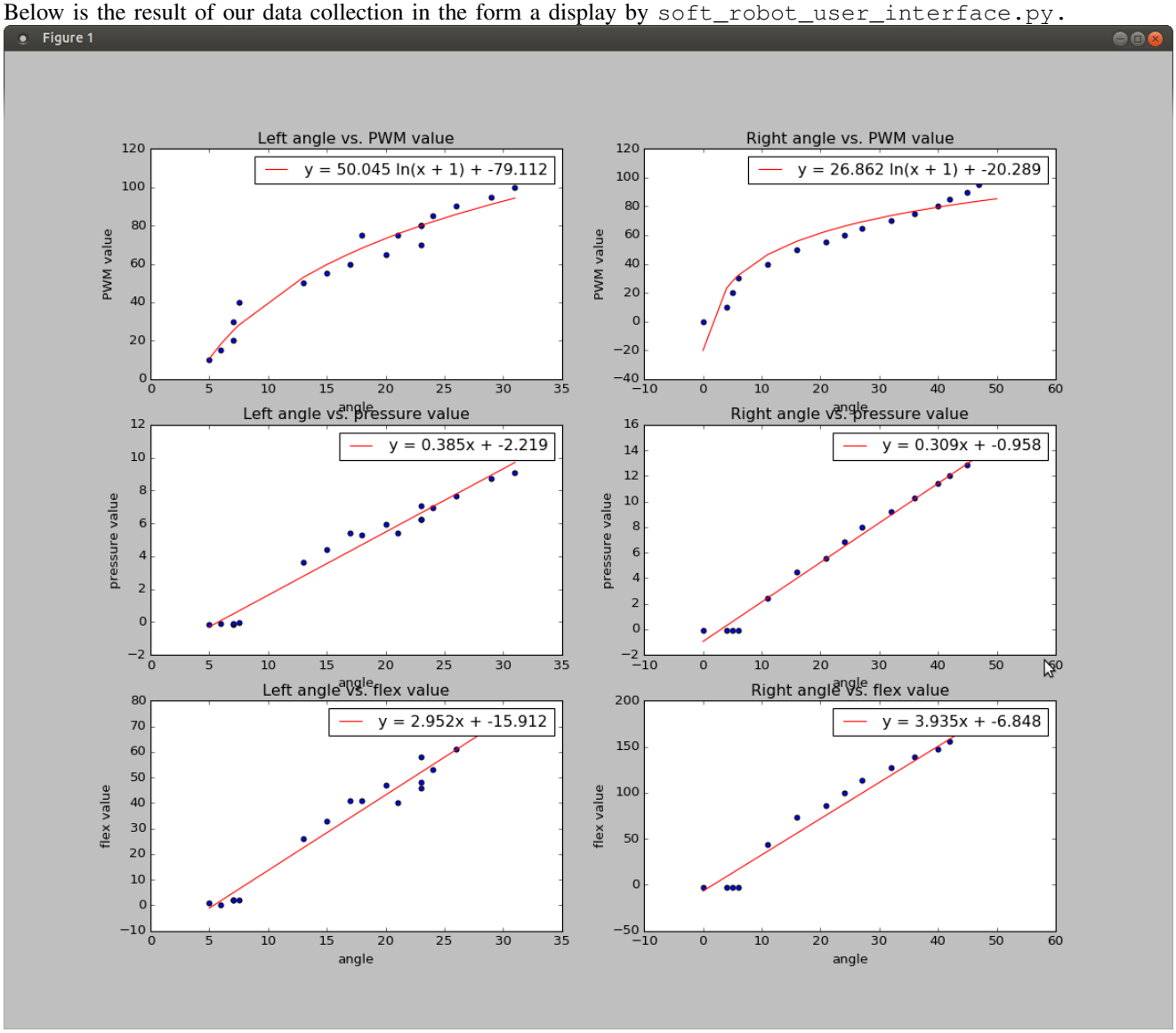
## I. GitHub Link

Our code can be found in this GitHub Repository!

## II. Data and Model Plots

Below is the result of our data collection in the form a display by `soft_robot_user_interface.py`.




## III. Fitted Model

For the top two plots of angle value vs. PWM value, both relationships exhibit logistic behavior as there is a high level of ascent starting off from zero, which begins to level out.

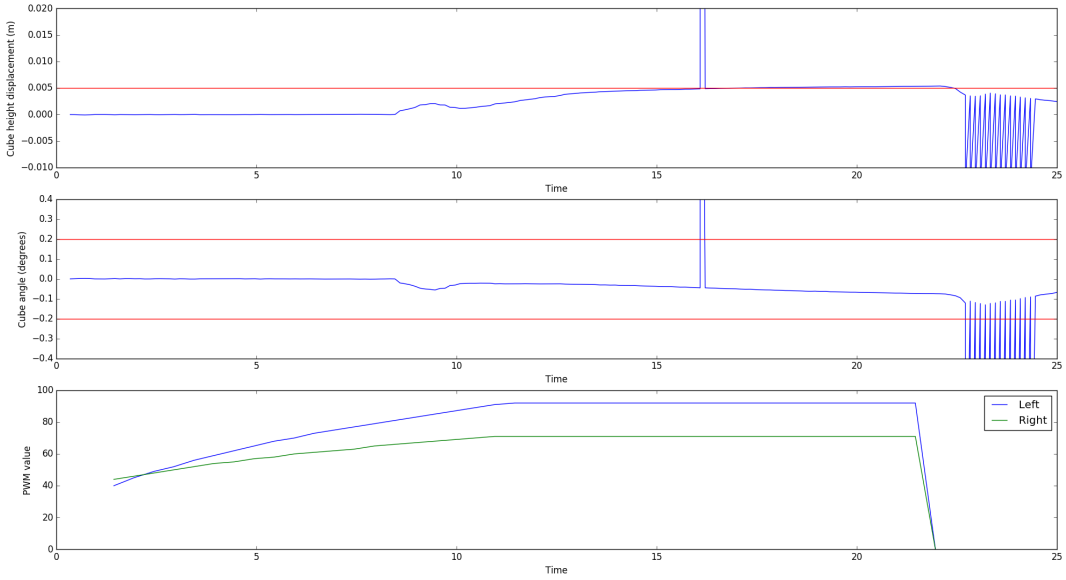
We have our left angle vs. PWM value giving us an equation of $y = 50.045ln(x + 1) - 79.112$ and our right angle vs. PWM value giving us the equation of $y = 26.862ln(x + 1) - 20.289$.

For the next two relationships of angle vs pressure value, the increase of pressure value led to a constant increase in the resulting angle. Thus, we were able to use linear regression to express the relationship. The left angle vs. pressure value resulted in an equation of $y = 0.385x - 2.219$ and our right angle vs. pressure value with an equation of $y = 0.309x - 0.958$. The right showed a closer linear relationship than that of the left.

The last two plots show the relationship between angle vs. flex value. Both of these demonstrate a linear relationship. The left had an equation of $y = 2.952x - 15.912$ and the right had an equation of $y = 3.935x - 6.848$.

## IV. Grasp Plots

Below is our generated grasp. plot showing the three relationships of cube height displacement, cube angle, and PWM value over time. We did have a few spikes in the graph (one at the 16 second mark) and quite a few around the 23-24 second mark which is probably a result of AR marker tracking difficulties. We ran into the issue where the webcam was unable to pick up the AR marker in quite a few runs.




## V. Grasp Video

Our grasp video can be found here Grasp Video Link.

## VI. Control input

1) We first tried to construct a control input, but it was not performing well. We then scrapped it and focused on the relationship between angle and PWM value of both the left and the right robot and utilized the two equations to predict the correct PWM value to obtain a desired angle. Once that was done, we fed the PWM value back directly to the robot.
2) We utilized a start angle of 10 and an end angle of 30. These were the defaults and they resulted in a ”successful” cube grasp already.
3) We did not have need for a designed feedforward term.
4) We did not have need for a designed feedback term.

## Acknowledgment

This was a fun project! Soft robotics are super cool!