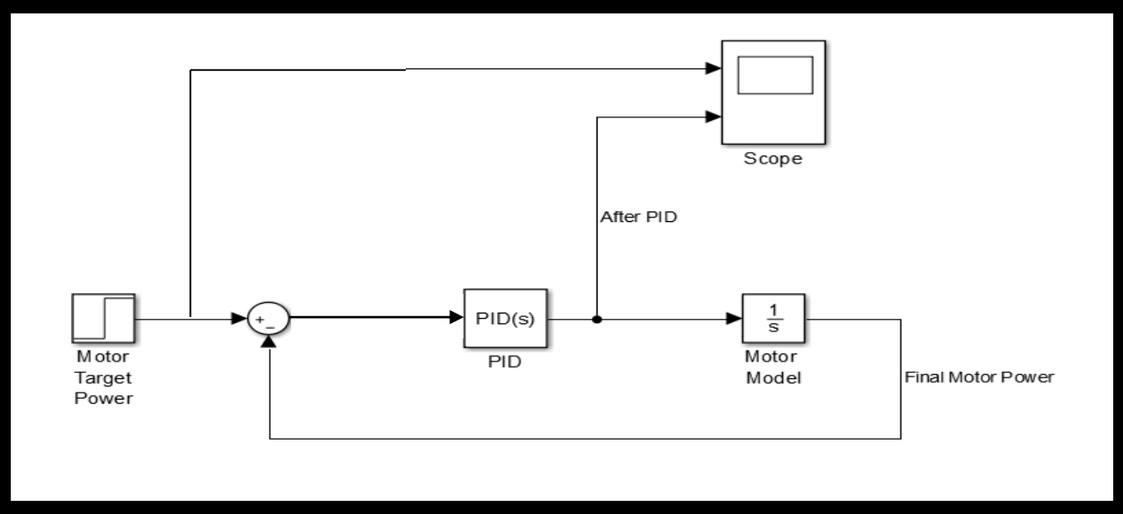
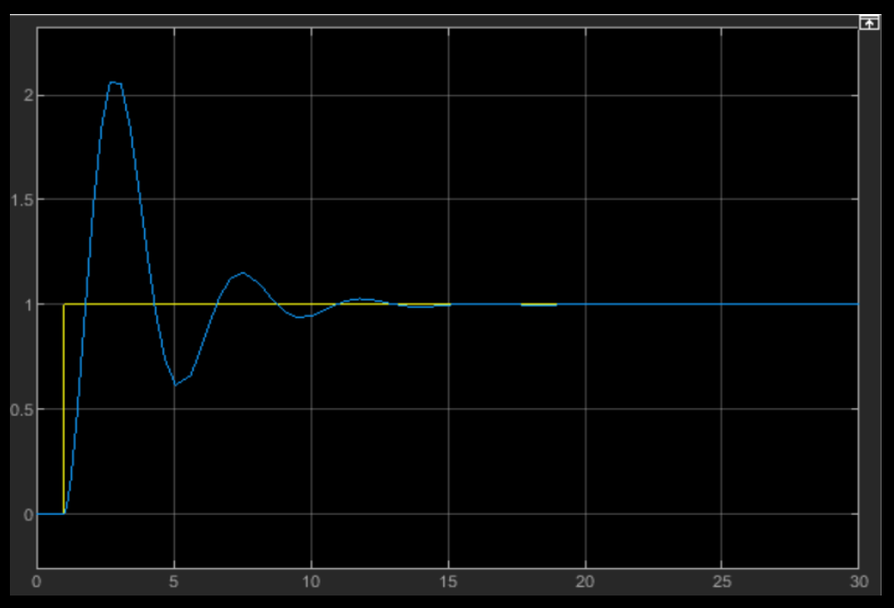
C-BASED PID CONTROL OF MINDSTORMS NXT ROBOT MOVEMENT

Team Members: Rohan Dighe, Zach Loy (Electrical Engineer), Gabe MacKinney (Aerospace Engineer), Shaurya Sinha (Software Engineer)

Task: Design, build, and program a Mindstorms NXT robot that can accomplish series of tasks mimicking a lunar rover while ensuring that the vehicle travels and maneuvers consistently and precisely.





Rohan's Contributions:

Helped Team Learn About PID Control – This project is from my freshman year (Spring 2017) before any formal control systems course was taken. With lots of help from my teammates, we were able to gain a basic understanding of PID control long before my ChE controls course

System Modeling and Data Analysis – Tested the robot (which was designed and built by all team members) to determine the natural response of the robot to a given software input. Then, I experimentally tried a variety of proportional and derivative constants to model a PD response that would give a response without excessive deviations from a straight line and a relatively accurate steady-state normalization. Once this was analyzed, integral control was considered using Riemann sums as an integral approximation method

Execution in RobotC – Used RobotC (a version of C made specifically for NXT applications) to program PID control of the motors with built-in libraries and code written from scratch

Course and Project Learnings:

Basic programming in Python, C and Matlab

Various applications of PID control to systems and what each type of control does

How to apply PID controls using software tools to real-life systems at the most basic level

	Encoder-moderated movement	Gyroscope-moderated movement
Degrees of Deviation for turning	2-3 degrees	0.04 – 0.07 degrees
Degrees of Deviation for straight movement	4-5 degrees	1-3 degrees