CprE 558 Project Proposal

Inverted Pendulum

# Group Members

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# Project Type

This is an implementation based project.

# Abstract (Project Goal)

In this project, we will be comparing the settling time, steady-state error, and peak-overshoot values for the Quanser IP02 Inverted Pendulum Cart using the same LQR controller on three different platforms: the Quanser VoltPAQ-X1 & G8-USB DAQ using Matlab/Simulink (Quanser implementation), a Xilinx Zybo board with the controller implemented through FreeRTOS (software implementation), and a Xilinx Zybo board with the controller implemented in hardware (hardware implementation).

# Approach

We will first develop a linearized model of our inverted pendulum system. This will provide a set of constant matrices that will be used in the LQR controller. Using the same constants across all three implementations, we will measure the settling time, steady-state error, and peak-overshoot of each implementation.

# Expected Outcomes

For all measured values, we expect the hardware implementation to perform the best, the software implementation to perform second best, and the Quanser implementation to perform the worst.

# References

* Quanser IPO2 Linear Inverted Pendulum Workbook (Student)
* Professor Shad’s EE4310 Lab #4 Handout
* P. Zhang, A. Mills, J. Zambreno and P. Jones, "**The Design and Integration of a Software Configurable and Parallelized Coprocessor Architecture for LQR Control**", *Journal of Parallel and Distributed Computing (JPDC)*, 2017.