

George Mason University

Ball and Beam Experiment Implement Controller using SIMULINK and QUARC

Report from laboratory experiment D.2 conducted on 22 April 2016
As part of ECE 429 Control Systems Lab
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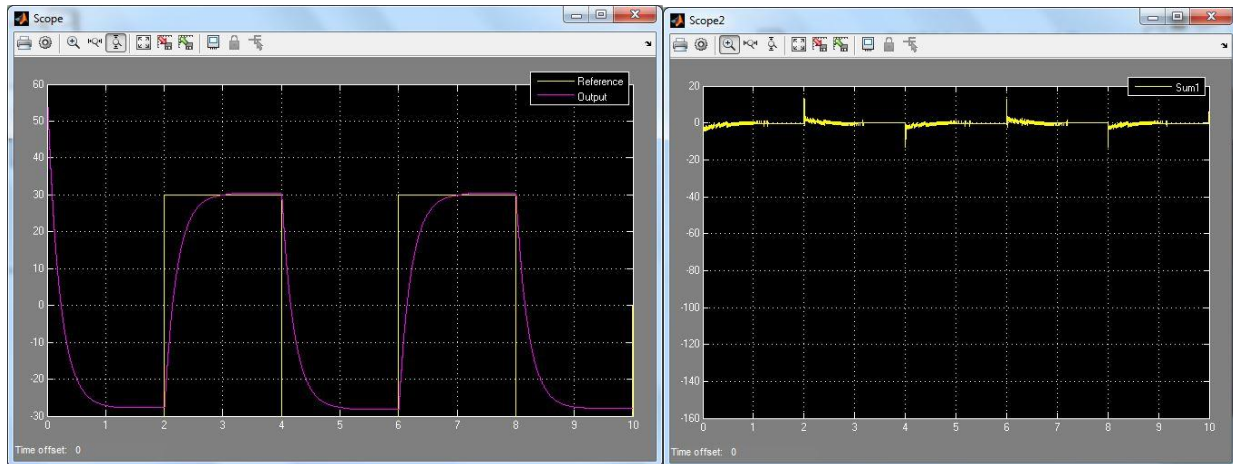
The Volgenau School of Engineering

Objective

To implement the controller designed unit D.1 in real-time using SIMULINK and QUARC hardware.

Task 1

Implement and check results of the servo motor controller from D.1.

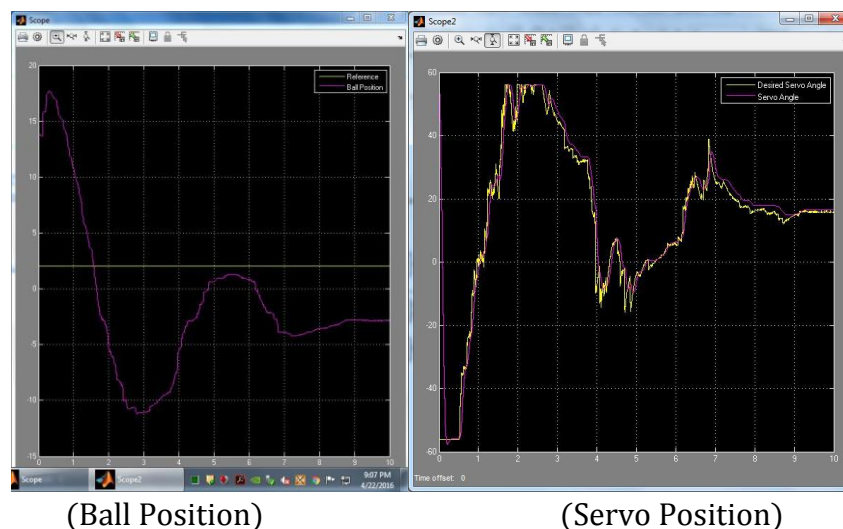


The system response has approximately a 1% overshoot and a settling time of nearly 1 second. The percent overshoot matches the SIMULINK simulation from the previous lab however the rise time is significantly slower and the settling time is significantly slower.

Task 2

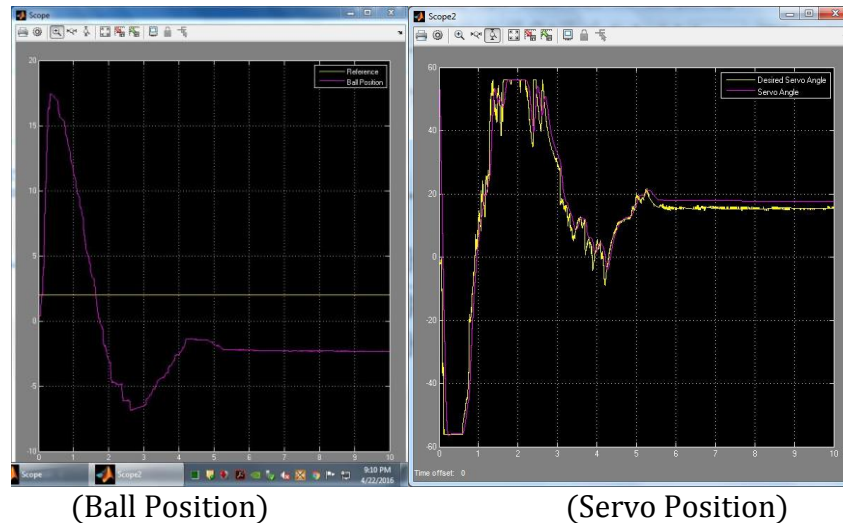
Implement the ball beam balancer for the two test cases on the QUARC hardware.

Test Case 1: $PO = 15\%$ and $t_s = 5s$.



The percent overshoot meets specification but the settling time does not. Settling time is approximately 9 seconds and the gains were designed for 5s.

Test Case 2: $PO = 1\%$ and $t_s = 3s$.



Percent overshoot specification is not met nor is the settling time met. Settling time is roughly 5 s when it was designed for 3s.

Conclusion

The simulation gave a crude representation of the system response. It failed to meet nearly every design specification. Translating from simulation to real world implementation it is apparent that you cannot design to meet specifications exactly, you must incorporate a safety factor. In addition to not meeting specifications, the output settled at ---2.5 rather than the reference input 2. This makes me think that our implementation or our interpretation of the data is wrong. Had I not put off writing this lab till the last minute I would go back and redo the lab but unfortunately I cant, and I am just submitting what I have.