Lab # 3 - Appendix D

Sample Graphs

You will find here sample graphs collected by previous cohorts of ELE639 student during this experiment. This should help you meet the expectations of how collected data should look like. Note that you can, and should, aim to do better than these - for example, some plots have too many cycles shown, to the detriment of the detail in the transient response.

Uncompensated Closed Loop Servo System

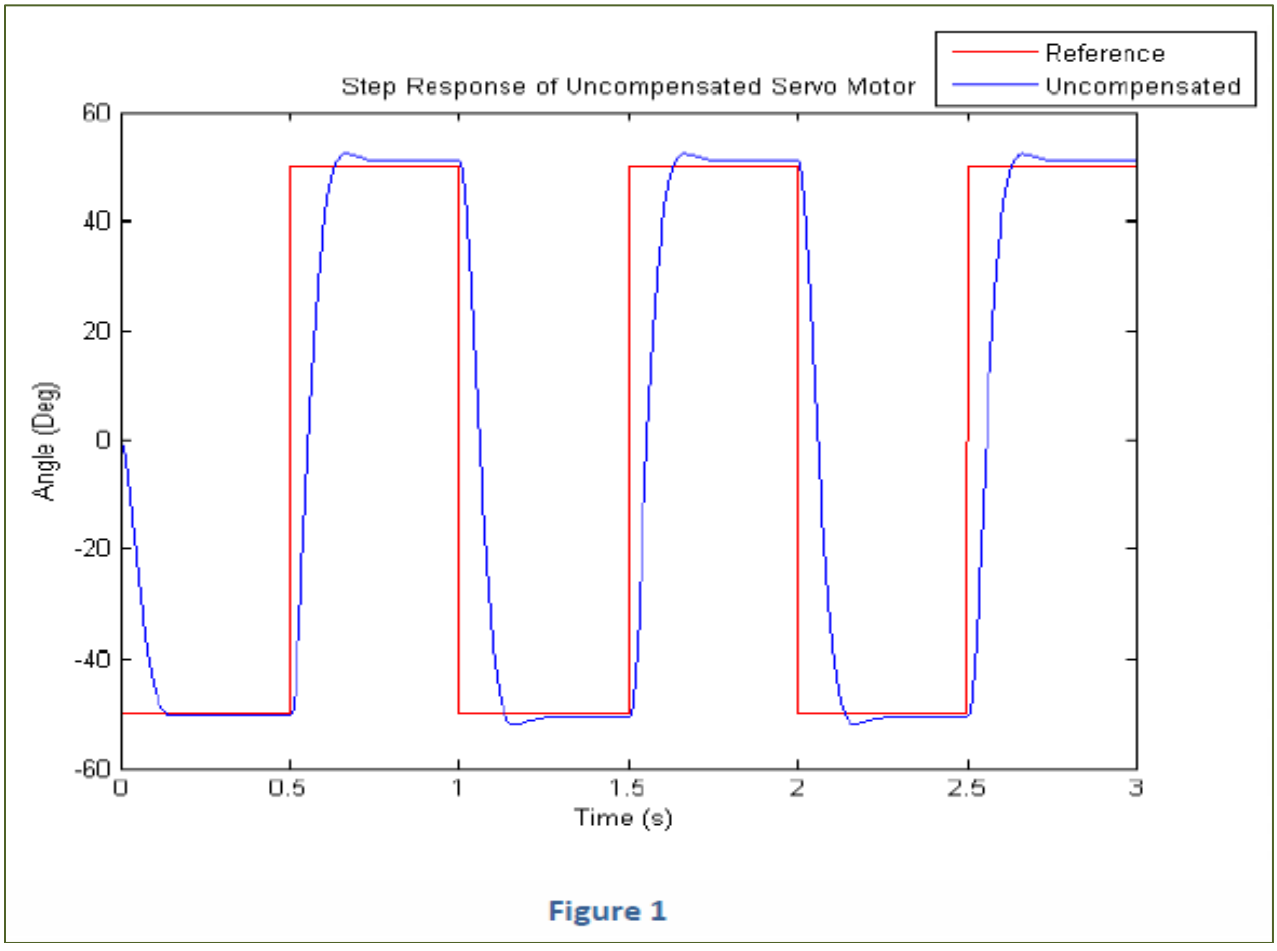


Figure 1

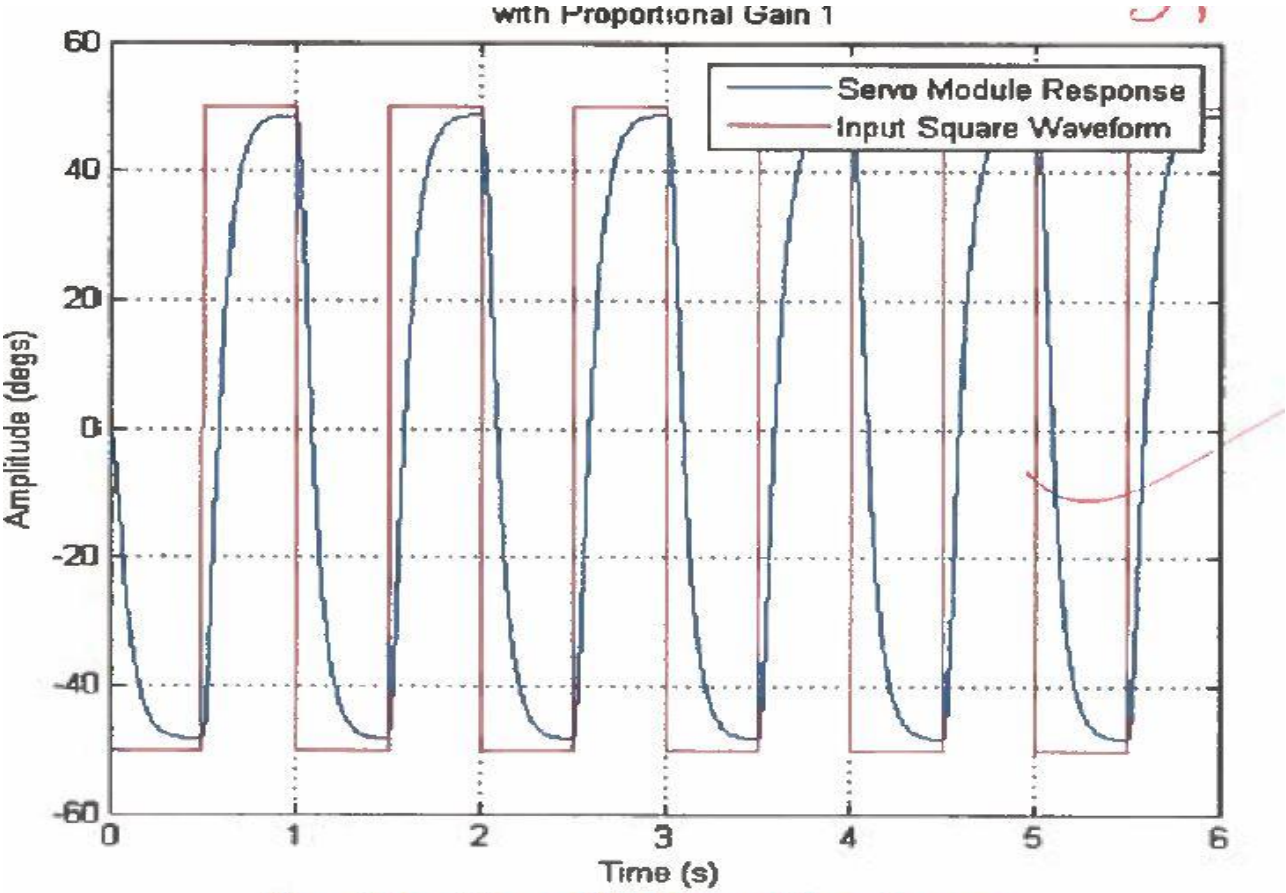


Figure 2. Input Square Waveform and Servo Response

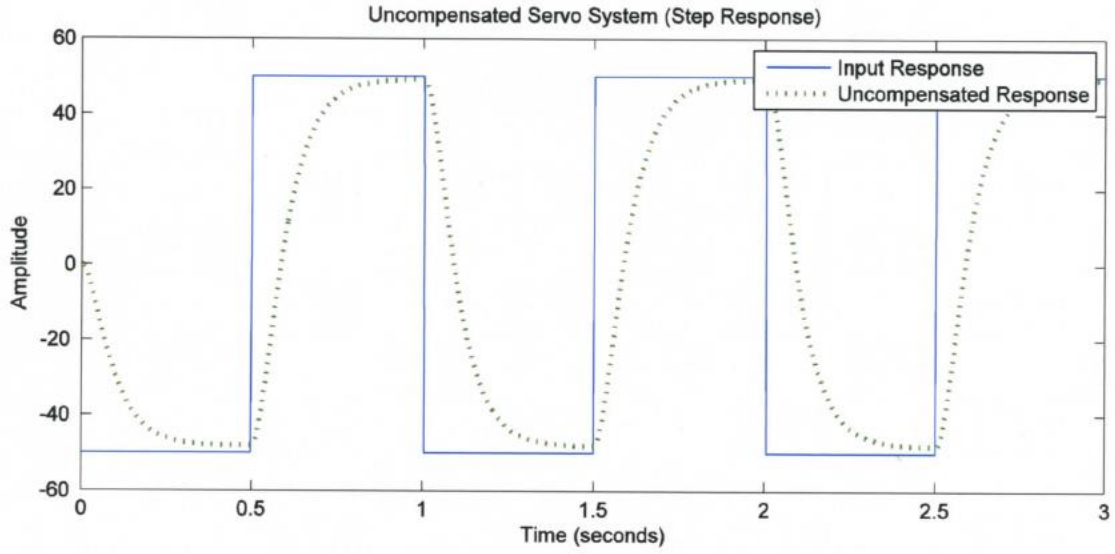


Figure 2: Uncompensated Servo System (Step Response)

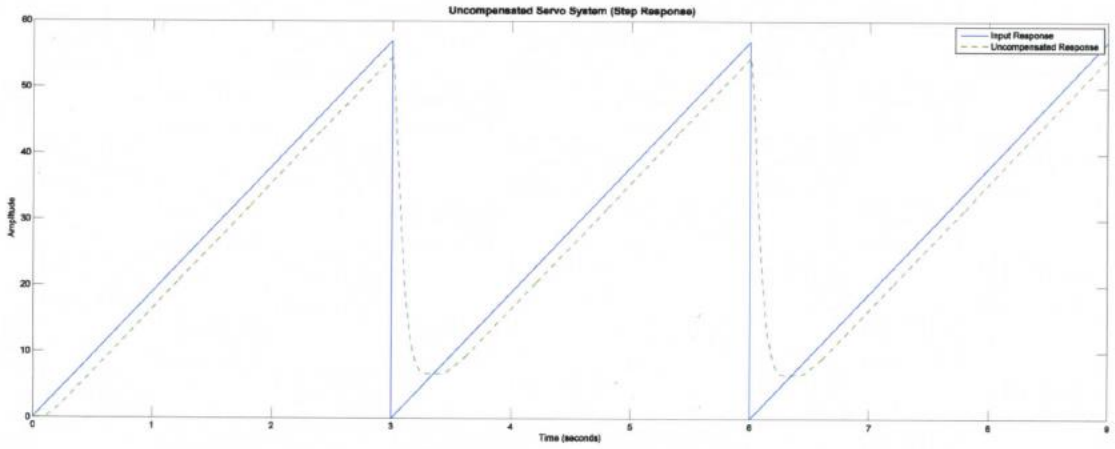
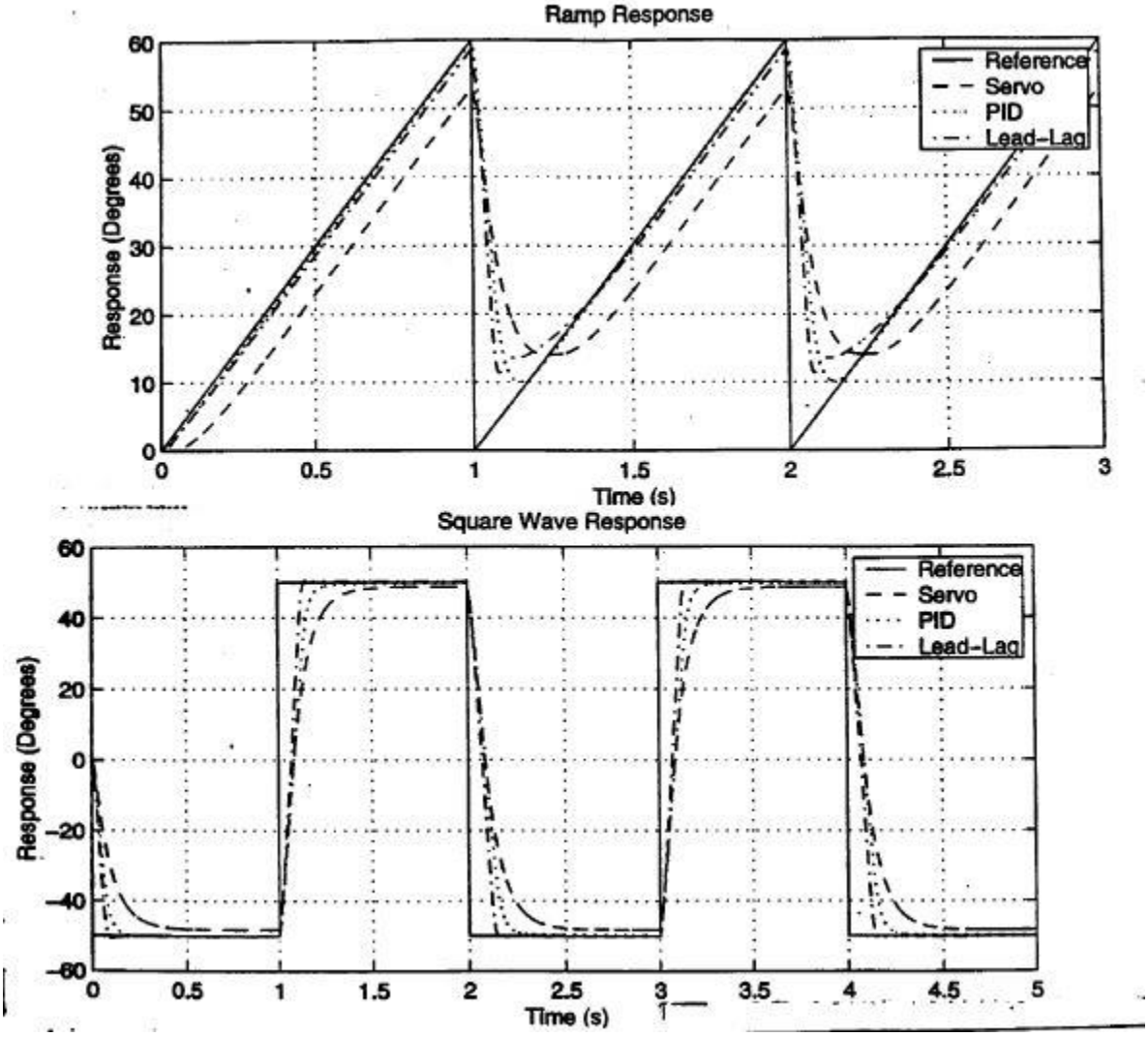
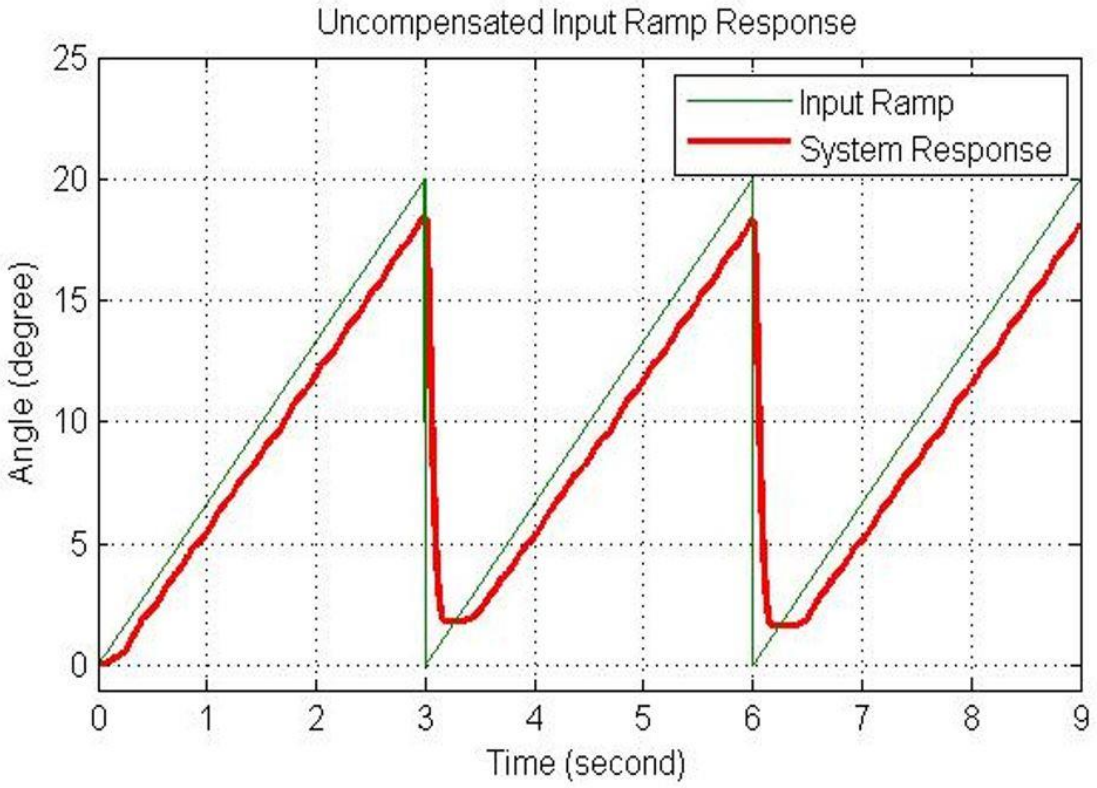


Figure 3: Uncompensated Servo System (Ramp Input)

The graphs below show comparison of several responses using different markers for the Black & White printing.





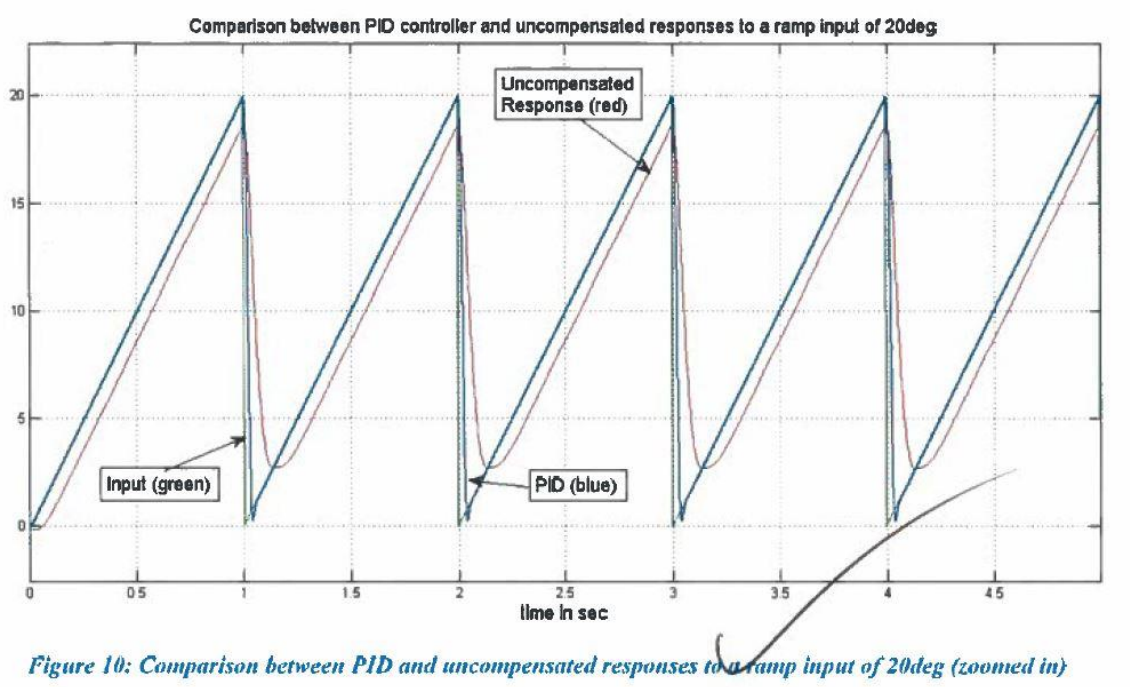
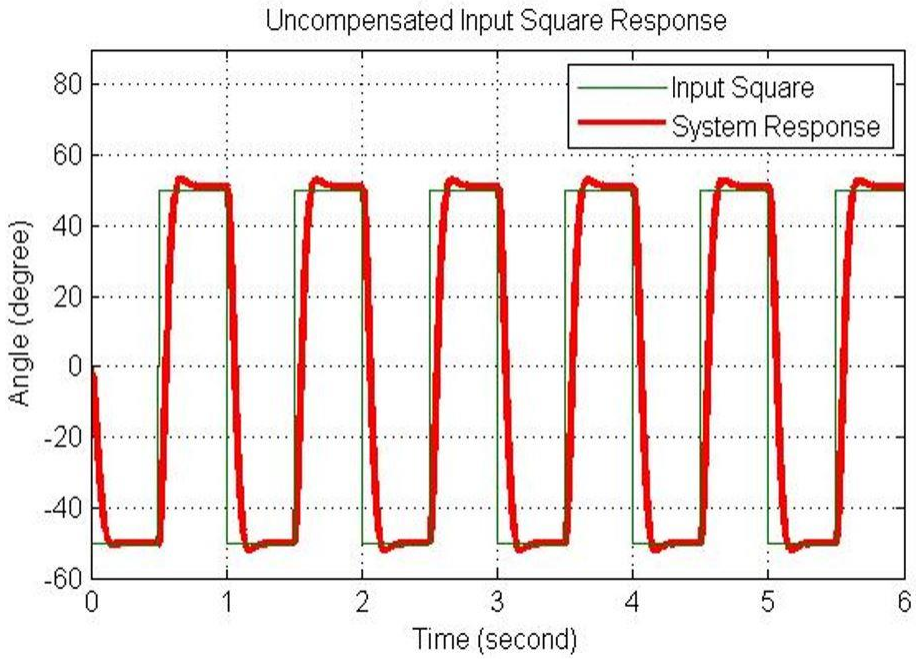


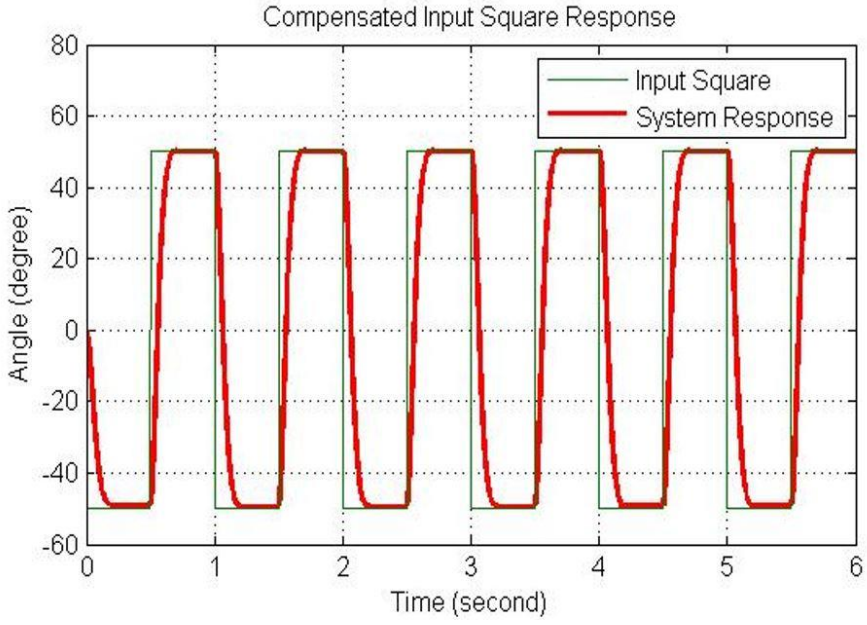
Figure 10: Comparison between PID and uncompensated responses to a ramp input of 20deg (zoomed in)

Samples of an Uncompensated System Ramp Response of $\pm 20^{o}$



Another Sample of an Uncompensated System Pulse Response of ±50º

PID Compensated Closed Loop Servo System



Sample of a Compensated PID system Pulse Response of ±50º

Compare the PID Compensated and Uncompensated Closed Loop Servo System Responses

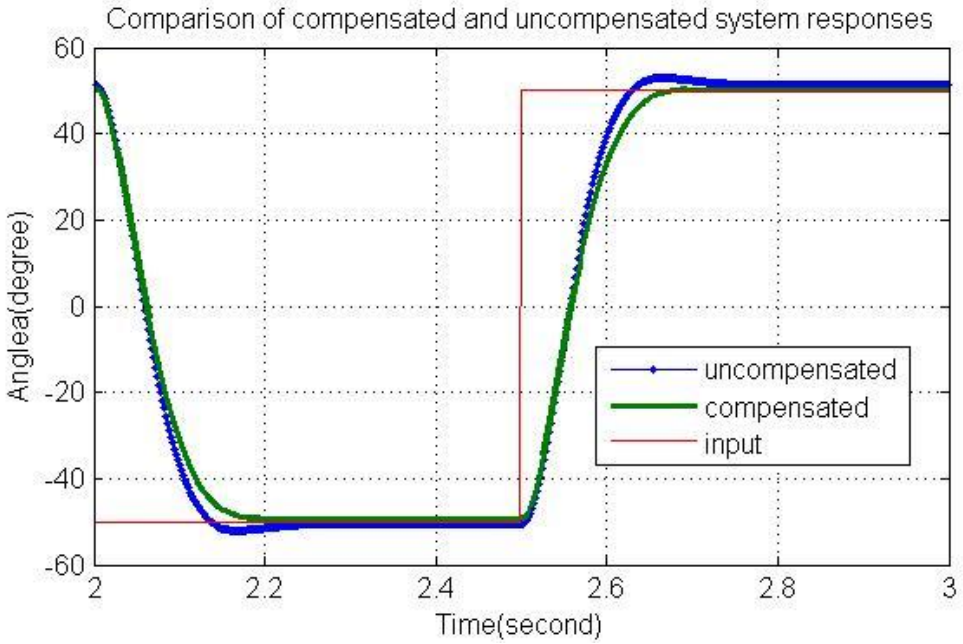


Figure 7: Comparison of Compensated and Uncompensated System Pulse Responses

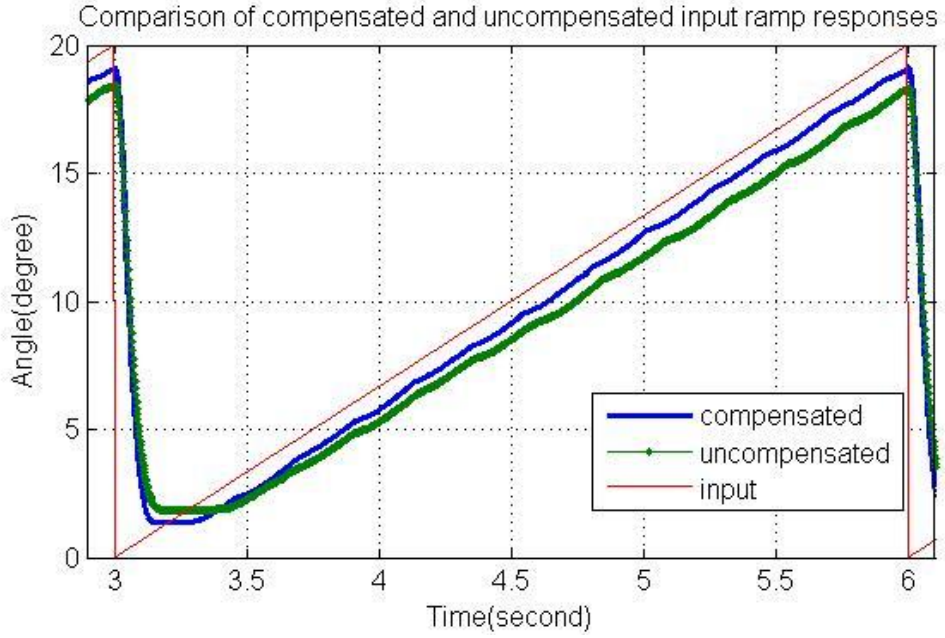
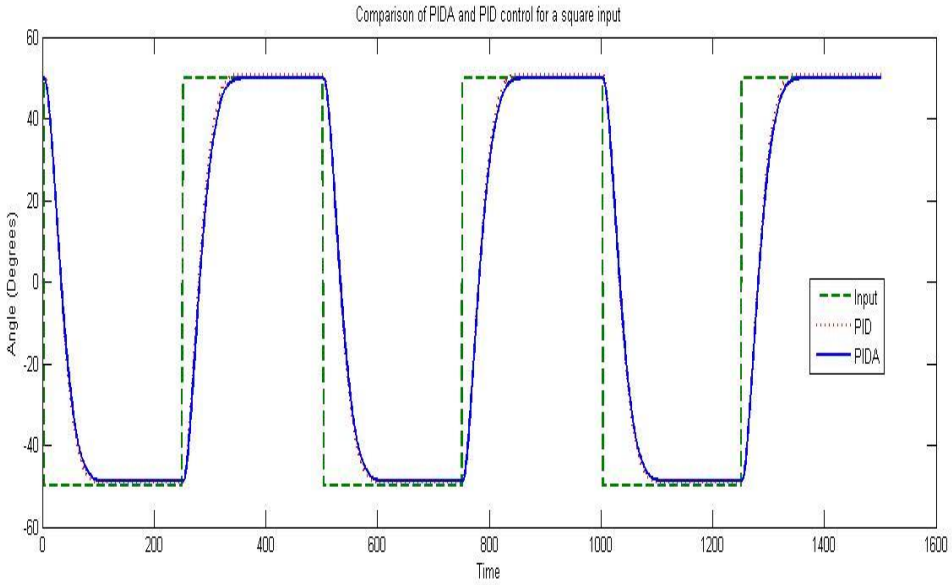
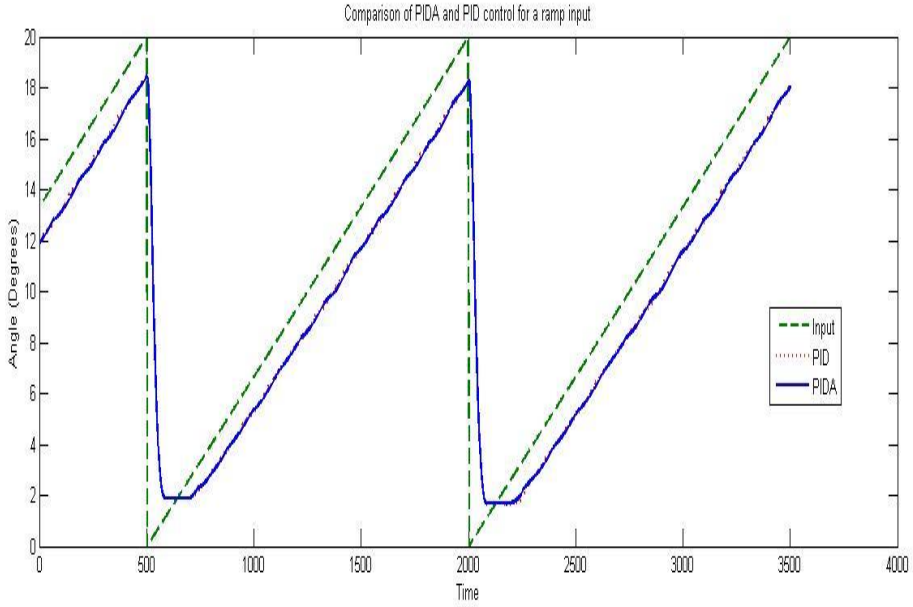


Figure 8: Comparison of Compensated and Uncompensated System Ramp Responses

Compare the PID with PIDA (PID + Anti-Windup) Compensated Closed Loop Servo System Responses





Comparison of PIDA and PID Control for a Ramp Input

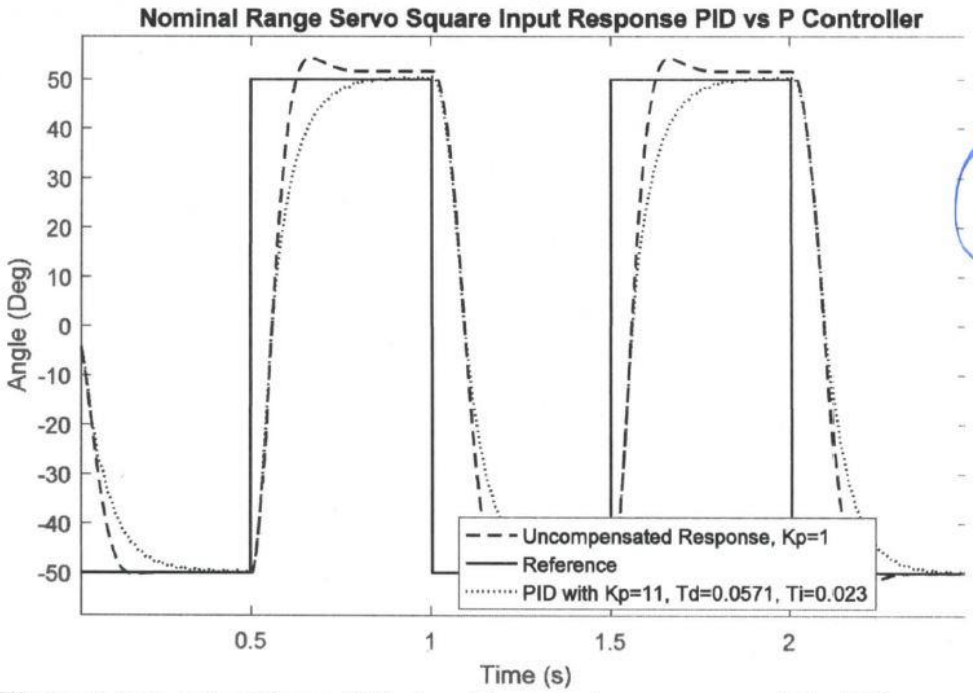


Figure 8. The actual Servo PID closed-loop system response of the PID versus the Uncompensated Response for square waveform input.

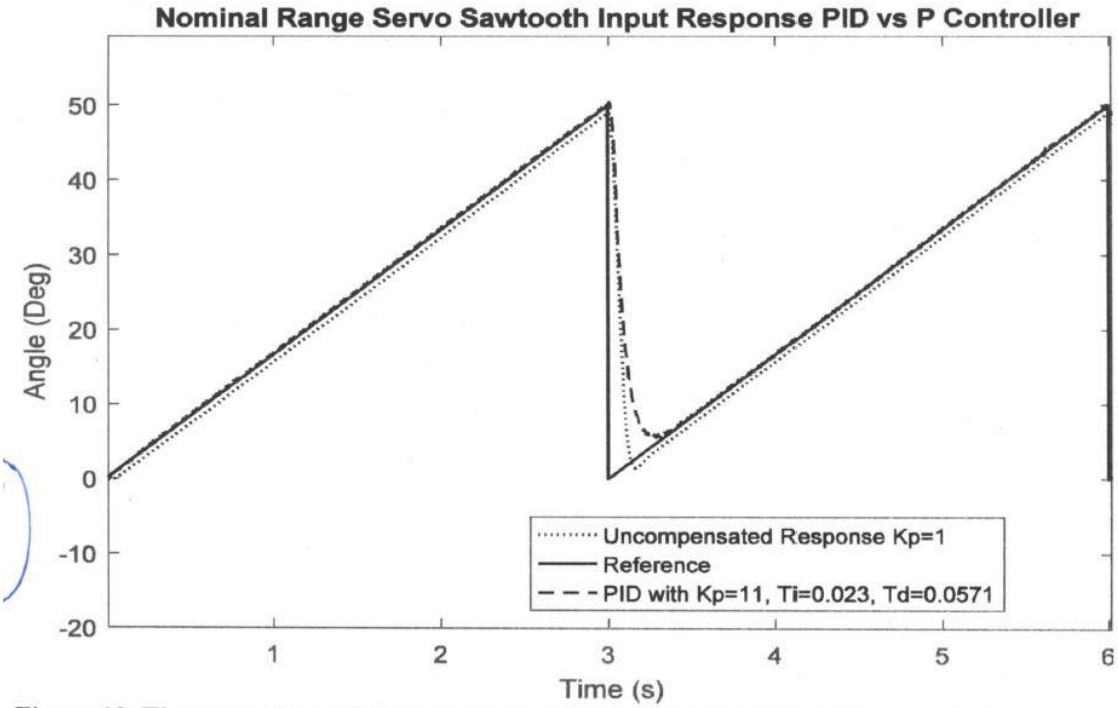


Figure 10. The actual Servo PID closed-loop system response of the PID versus the uncompensated system, for saw-tooth waveform input.

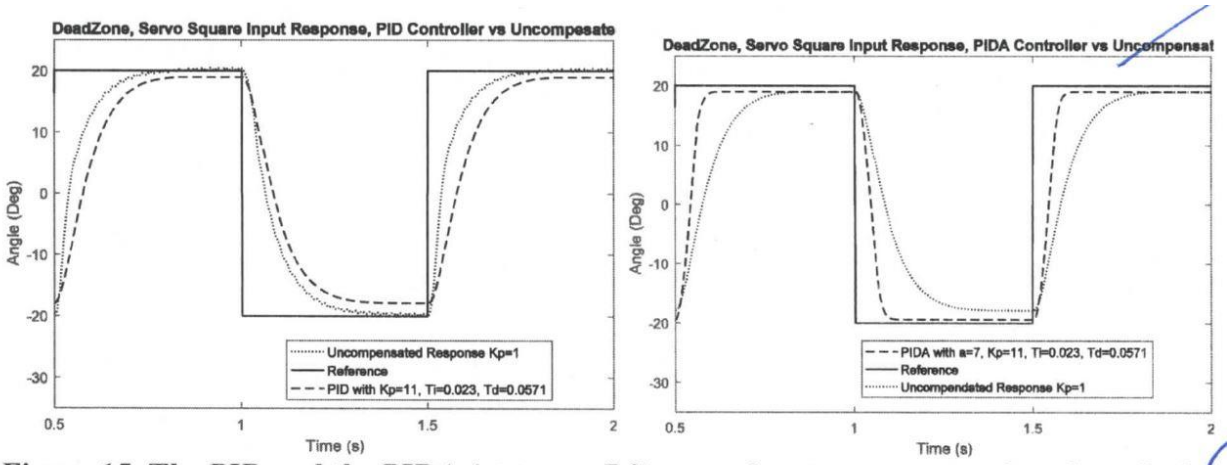
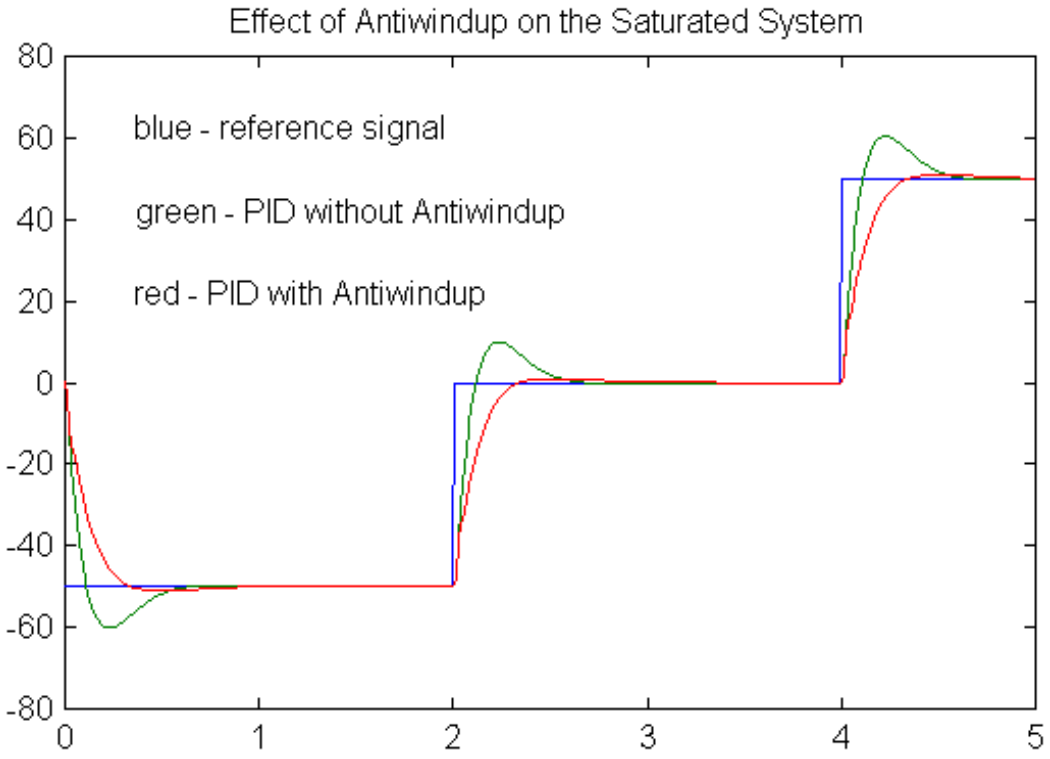


Figure 15. The PID and the PIDA (at $tau_a = 7.0$) control system responses benchmarked against the uncompensated response, all under the Deadzone effect

NOTE: although the above graphs do not show any significant effect of the Anti-windup Scheme, it simply means that the controller wasn't saturating in that case. Generally, you can expect some saturation, in which case the graphs below may be more representative.



Effect of PID-A on the Servo Response