

ME 360: FUNDAMENTALS OF SIGNAL PROCESSING, INSTRUMENTATION, AND CONTROL

Experiment No. 6 Speed Control of a DC Electric Motor Data Sheet

Simulation of Motor-generator System

Test Case	V_{in} [V]	ω [rpm]	V_{gen} [V]
1	3		
2	4		
3	5		

V_{in} = input to motor [V] ω = motor speed [rpm]

Simulation of Motor-generator System with PI Speed Control

Test Case	Set Point [rpm]	K_p	K_I	Load [N-m]	Steady-State Speed [rpm]	Generator Voltage [V]	Response Time [s]	Steady-State Error
1	Open-loop	1000	1	0	0			
2	Closed-loop	1000	2	0	0			
3	Closed-loop	1000	2	0	0.02			
4	Closed-loop	1000	2	0	0.04			
5	Closed-loop	1000	4	0	0.04			
6	Closed-loop	1000	8	20	0.04			
7	Closed-loop	1000	8	50	0.04			
8	Closed-loop	1000	8	100	0.04			

Observations / Conclusions

Sketch the typical motor response with and without integral control. Label the sketches appropriately.

Testing the Motor-generator System with PI Speed Control

Test Case		Set Point [rpm]	K_p	K_i	Motor Speed [rpm]	Generator Voltage	Steady-State Error
1	Closed-loop	1000	4	0			
2	Closed-loop	1000	4	10			
3	Closed-loop	1000	4	20			
4	Closed-loop	1000	4	50			
5	Closed-loop	1000	8	10			

Sketch the motor response for Cases 2, 3 and 5. Label the sketches appropriately.

Ask your TA to help you add a disturbance to the motor's shaft when the controller is running. Comment on how the motor reacts without and with integral control.

Observations / Conclusions

Integral Windup. Sketch a motor response with the integral windup problem. Why does this large overshoot occur?