

ECE 761: Homework #15: Dynamics of a DC Servo Motor

The dynamics of a DC servo motor are

$$s\theta = \omega = \left(\frac{K_t}{(Js+D)(Ls+R)+K_t^2} \right) V_a$$

This gives five parameters to determine

- 1) Use a multimeter to measure the armature resistance and inductance

R_a <i>Ohms</i>	L_a <i>Henries</i>

- 2) Apply 10V DC to the DC servo motor and measure the current draw and the speed. From this, determine K_t

$$V_a = I_a R_a + K_t \omega$$

V_a <i>Volts</i>	I_a <i>Amps</i>	ω <i>rad / sec</i>	K_t <i>Vs / rad</i>

- 3) Apply a +10V DC step input to the motor and measure the step response.

- From the step response, determine a 1st-order approximation for the motor.
- Using this 1st-order approximation, determine J and D

$$\omega \approx \left(\frac{K_t}{(Js+D)(R)+K_t^2} \right) V_a = \left(\frac{\left(\frac{K_t}{JR} \right)}{s + \left(\frac{DR+K_t^2}{JR} \right)} \right) = \left(\frac{a}{s+b} \right) V_a$$

1st-Order Approximation	J <i>kg m²</i>	D <i>Nms / rad</i>