

## Recommended Assessment

### Parameter Estimation

1. Show the process and the expressions you derived in the lab for solving for  $R_m$  under motor stalled conditions.
2. Based on your experiments to estimate the motor resistance, fill out the following table with your measured current and calculated resistance values. Take the average of all the calculated resistance values and compare this with the motor resistance value from the Qube-Servo 3 User Manual.

Applied Voltage $V_m$ (V)	Measured Current $I_m$ (A)	Resistance $R_m$ ( $\Omega$ )
-5		
-4		
-3		
-2		
-1		
+1		
+2		
+3		
+4		
+5		
Avg		

3. Show the process and the expressions you derived in the lab for solving for  $k_m$ . Assume you already know the motor resistance  $R_m$ .

4. Based on your experiments to estimate the back EMF, fill out the following table with your measured speed and current and calculated back EMF values. Take the average of all the calculated back EMF values and compare this with the motor back EMF value from the Qube-Servo 3 User Manual, why is there discrepancies?

Applied Voltage $V_m$ (V)	Measured Speed $\omega_m$ (rad/s)	Measured Current $I_m$ (A)	Back-EMF $k_m$ (V-s/rad)
-5			
-4			
-3			
-2			
-1			
+1			
+2			
+3			
+4			
+5			
Avg			

5. The motor shaft of the Qube-Servo 3 is attached to a *load hub and a disk load*. Based on the parameters given in the Qube-Servo 3 User Manual, if you calculate the equivalent moment of inertia that is acting on the motor shaft, what are the moments of Inertia? (Refer to concept review and application guide)
6. Formulate the differential equation for  $\omega_m$  using the equations provided in the concept review outlined in the application guide.

What is the Speed to Voltage ratio equation? (**Hint:** Obtain the Voltage  $V_m(s)$  to Speed  $\Omega_m(s)$  transfer function by applying a Laplace Transform to the derived differential equation).

7. Evaluate the transfer function with the resistance and back-EMF parameters you found experimentally in this lab.

If you have done the Step Response Modeling lab, compare your result with the transfer function obtained in that lab.