

MAE 106 Post-Laboratory Quiz 2009

Laboratory Exercise #3: P-Type Velocity Control of a Motor

In Lab 3, you built a motor velocity controller, using a proportional feedback controller.

The control law for the experiment was:  $u = -K (\omega_{actual} - \omega_d)$

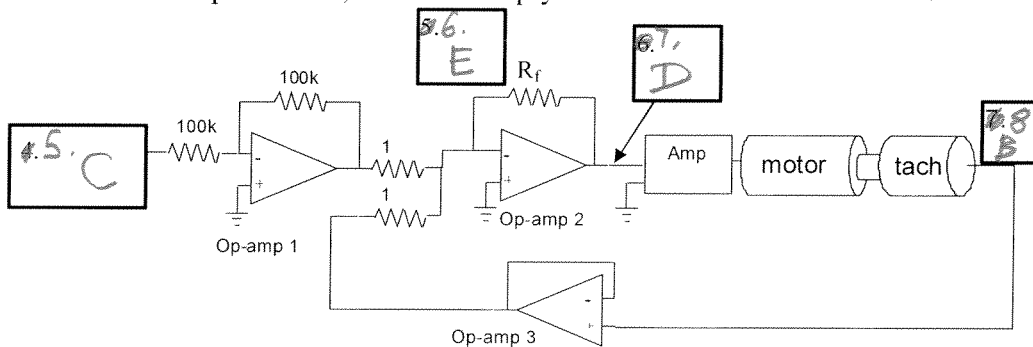
1. What is  $u$ ?  
 A. motor current      B. actual motor speed      C. desired motor speed  
 D. the control input to the motor/amplifier      E. feedback gain

2. What is  $K$ ? Choose from letters above. **E**

3. What is  $\omega_d$ ? Choose from letters above. **C**

4. Was  $K$  positive or negative?  
**A. Positive**      B. Negative

Below is a control circuit that you used to implement the P-type position control. Using the same letters as in problem 1, label the empty boxes with the correct letters.

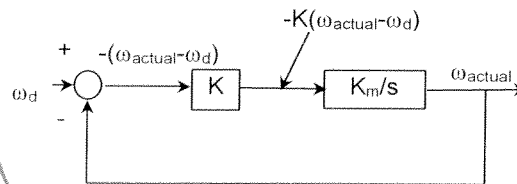


Below is a block diagram of the velocity control system you built in lab. If you find the transfer function, you'll find it has the form of a filter. What kind of filter is it?

- A. Band pass      B. High pass      C. Notch      D. Torque      **E. Low pass**

What is the cut-off frequency of the filter?

- A.  $1/K_m$   
**B.  $KK_m$**   
 C.  $1/(KK_m)$   
 D.  $K_m$   
 E.  $K/K_m$



What is the gain of the filter for low frequency inputs?

- A.  $1/K_m$   
 B.  $K_m/K$   
**C. 1**  
 D.  $K_m$   
 E.  $K/K_m$

Handwritten derivations:

$$\omega_a = \frac{K_m}{s} (-K(\omega_a - \omega_d))$$

$$\omega_a = \frac{K_m K}{s} \omega_a + \frac{K K_m}{s} \omega_d$$

$$\omega_a = \left( \frac{K K_m / s}{1 + \frac{K K_m}{s}} \right) \omega_d$$

$$\omega_a = \frac{K K_m}{s + K K_m} \omega_d$$

$$\omega_a = \frac{1}{1 + \frac{1}{K K_m} s} \omega_d$$

let  $s=0$ , then  $\omega_a = \frac{1}{1 + \frac{1}{K K_m} \cdot 0} \omega_d = (1) \omega_d$