

Name:  
Honor Code:

1. Figure 1-a has 0.67 SSE due to a step input. A controller is then designed so that the new system is as shown in Figure 1-b.

- (a) What type of controller is this? *LAG*  
(b) What is the new SSE? *0.4*

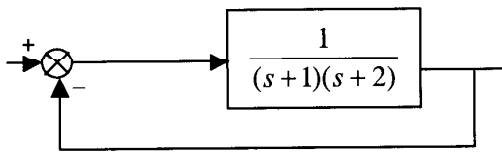


Figure 1-a

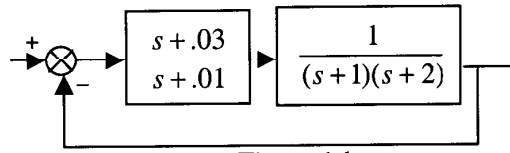


Figure 1-b

$$SSE = \lim_{s \rightarrow 0} \frac{1}{1 + G(s)} = \frac{1}{1 + \lim_{s \rightarrow 0} \frac{(s+0.3)}{(s+0.1)(s+1)(s+2)}} = \frac{1}{1 + \frac{3}{2}} = \frac{2}{5}$$

2. Figure 2-a has 2.67s settling time and 11.51% overshoot. A controller is then designed so that the new system is as shown in Figure 2-b.

- (a) What type of controller is this? *LEAD*  
(b) What is the new overshoot and settling time? *T<sub>s</sub> = 2s, OS = 11.51%*

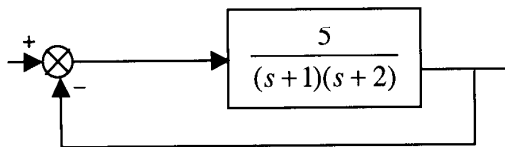


Figure 2-a

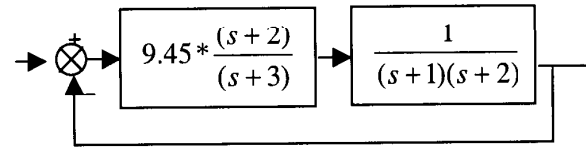
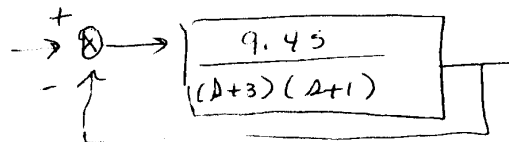


Figure 2-b



$$\rightarrow \frac{9.45}{s^2 + 4s + 12.45}$$

$$\omega_n = \sqrt{12.45} \quad \omega_n = 3.52$$

$$2\zeta\omega_n = 4 \quad \zeta = 0.568$$

$$OS = \frac{11.51\%}{}$$

$$T_s = \frac{4}{\zeta\omega_n} = 2s$$