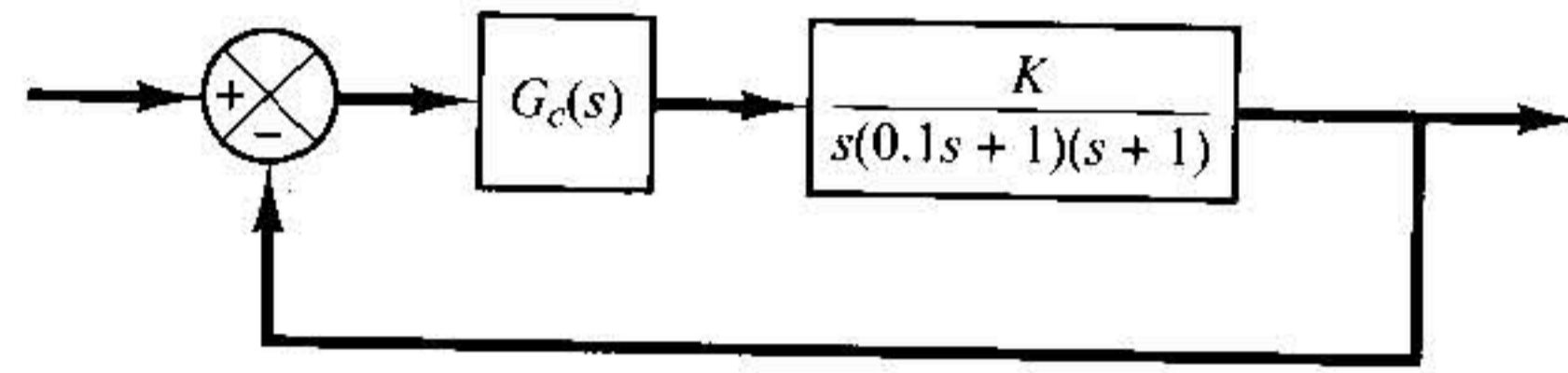
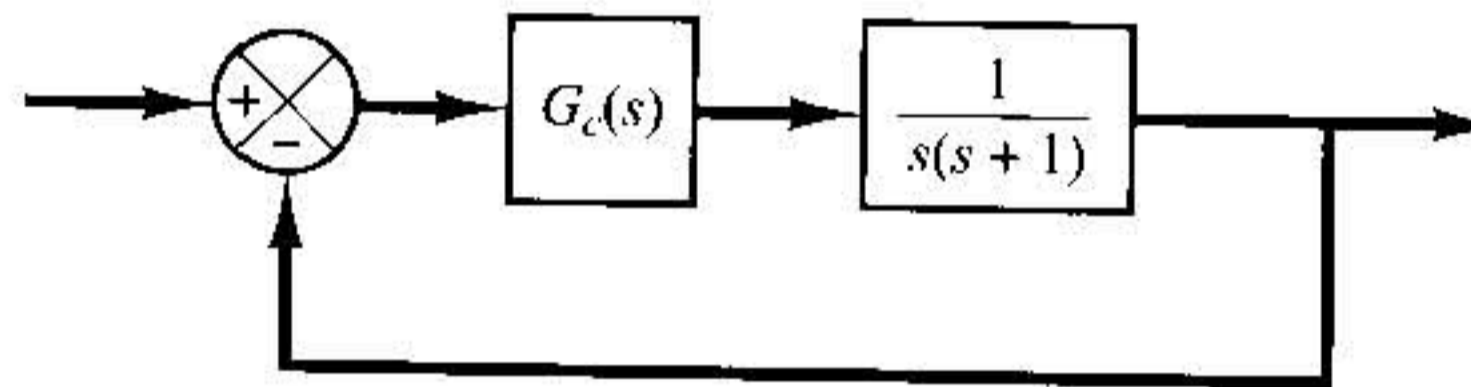


**B-9-5.** Referring to the closed-loop system shown in Figure 9-63, design a lead compensator  $G_c(s)$  such that the phase margin is  $45^\circ$ , gain margin is not less than 8 dB, and the static velocity error constant  $K_v$  is  $4.0 \text{ sec}^{-1}$ . Plot unit-step and unit-ramp response curves of the compensated system with MATLAB.



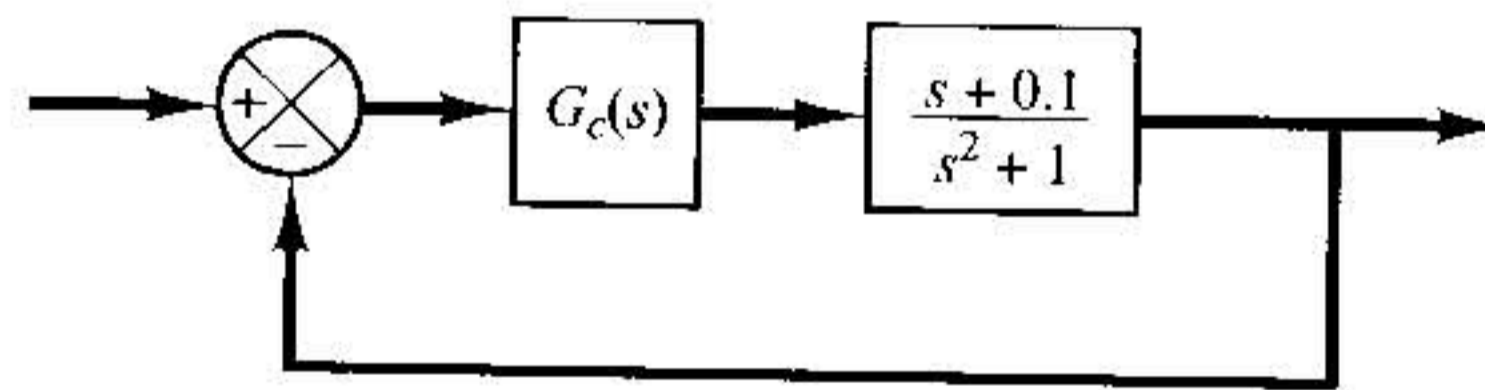
**Figure 9-63**  
Closed-loop system.

**B-9-6.** Consider the system shown in Figure 9-64. Design a compensator such that the static velocity error constant  $K_v$  is  $50 \text{ sec}^{-1}$ , phase margin is  $50^\circ$ , and gain margin not less than 8 dB. Plot unit-step and unit-ramp response curves of the compensated and uncompensated systems with MATLAB.



**Figure 9-64**  
Control system.

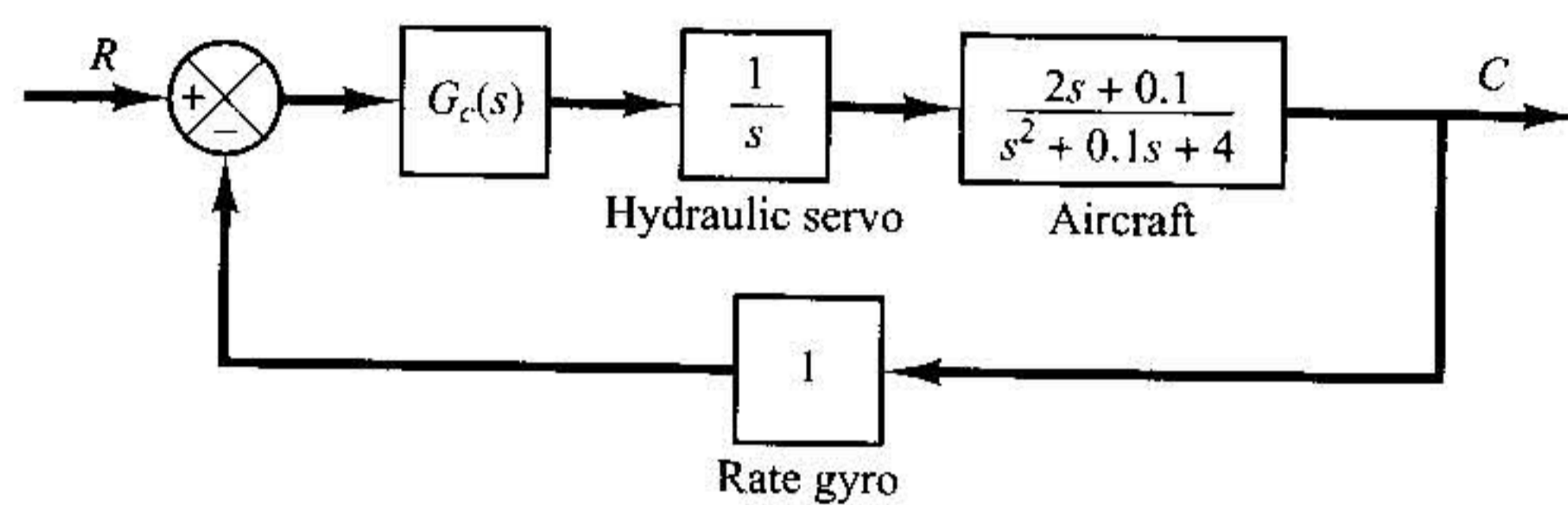
**B-9-7.** Consider the system shown in Figure 9-65. Design a compensator such that the static velocity error constant is  $4 \text{ sec}^{-1}$ , phase margin is  $50^\circ$ , and gain margin is 10 dB or more. Plot unit-step and unit-ramp response curves of the compensated system with MATLAB. Also, draw a Nyquist plot of the compensated system with MATLAB.



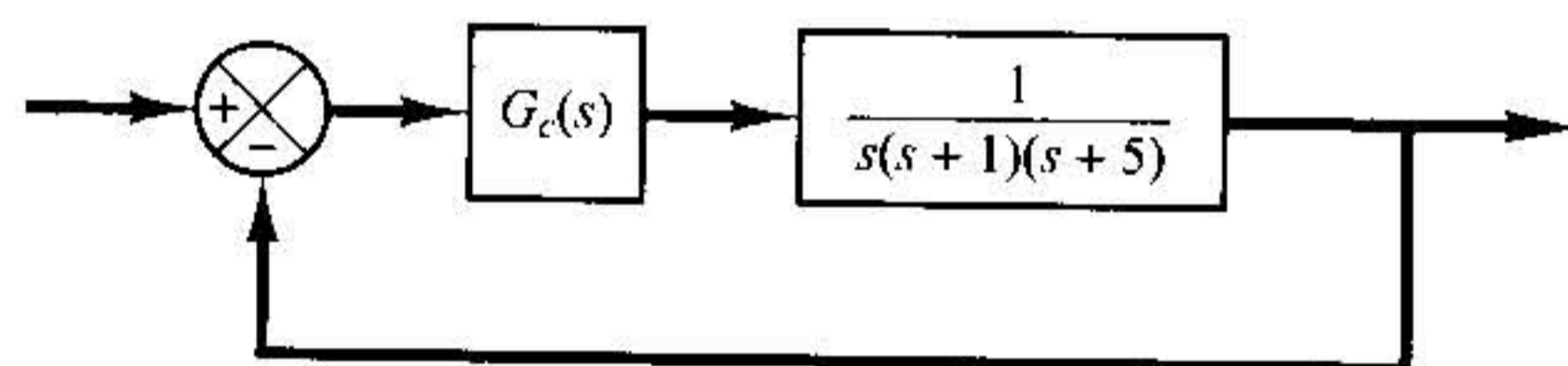
**Figure 9-65**  
Control system.

**B-9-8.** Consider the system shown in Figure 9-66. It is desired to design a compensator such that the static velocity error constant is  $4 \text{ sec}^{-1}$ , phase margin is  $50^\circ$ , and gain margin is 8 dB or more. Plot the unit-step and unit-ramp response curves of the compensated system with MATLAB.

**B-9-9.** Consider the system shown in Figure 9-67. Design a lag-lead compensator such that the static velocity error constant  $K_v$  is  $20 \text{ sec}^{-1}$ , phase margin is  $60^\circ$ , and gain margin is not less than 8 dB. Plot the unit-step and unit-ramp response curves of the compensated system with MATLAB.



**Figure 9-66**  
Control system.



**Figure 9-67**  
Control system.