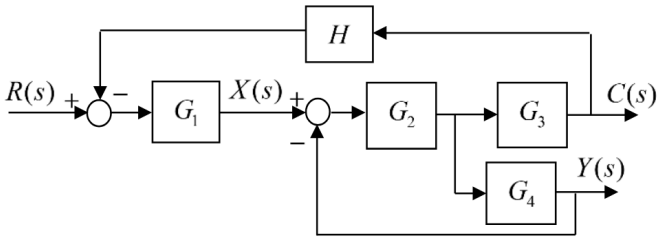
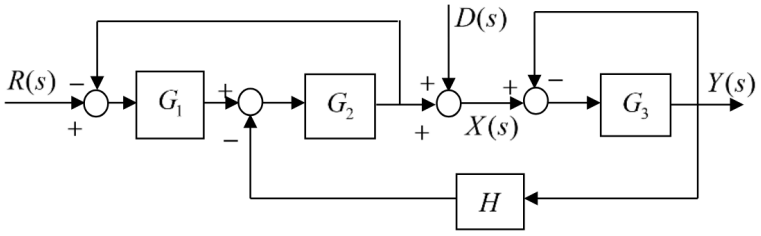
Course : CSE461 (Introduction to Robotics)

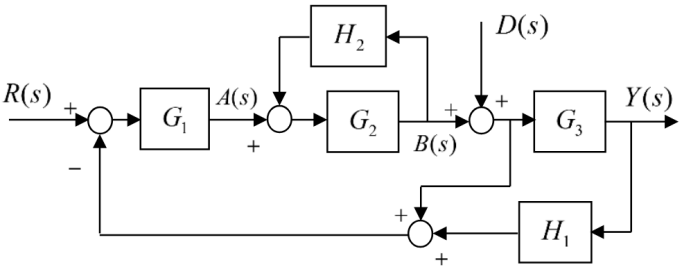
1. The closed-loop system shown in the block diagram has ***one input*** signal ($R(s)$) and ***two output*** signals ($C(s)$ and $Y(s)$). Find the transfer functions $\frac{Y}{X}(s)$, $\frac{Y}{R}(s)$, and $\frac{C}{R}(s)$.



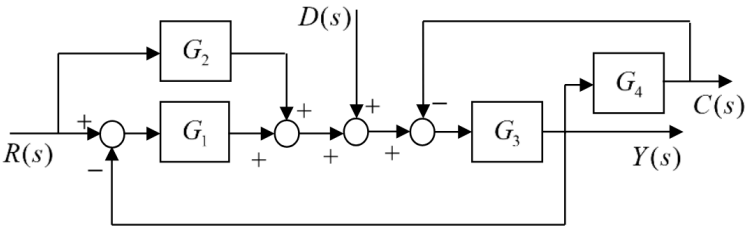
2. The closed-loop system shown in the block diagram has two input signals ($R(s)$ and $D(s)$) and one output signal ($Y(s)$). Find the transfer functions $\frac{Y}{X}(s)$, $\frac{Y}{R}(s)$, and $\frac{Y}{D}(s)$.



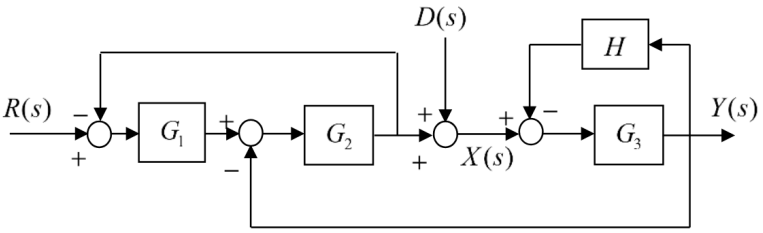
3. The closed-loop system shown in the block diagram has two input signals ($R(s)$ and $D(s)$) and one output signal ($Y(s)$). Find the transfer functions $\frac{B}{A}(s)$, $\frac{Y}{R}(s)$, and $\frac{Y}{D}(s)$.



4. The closed-loop system shown in the block diagram has ***one input*** signal ($R(s)$) and ***two output*** signals ($C(s)$ and $Y(s)$). Find the transfer functions $\frac{Y}{D}(s)$, $\frac{C}{D}(s)$, and $\frac{Y}{R}(s)$.



5. The closed-loop system shown in the block diagram has two input signals ($R(s)$ and $D(s)$) and one output signal ($Y(s)$).Find the transfer functions $\frac{Y}{X}(s)$, $\frac{Y}{R}(s)$, and $\frac{Y}{D}(s)$.



Answers

1.

$$\frac{Y}{X}(s)=\frac{G_2G_4}{1+G_2G_4} \qquad \frac{Y}{R}(s)=\frac{G_1G_2G_4}{1+G_2G_4+G_1G_2G_3H} \qquad \frac{C}{R}(s)=\frac{G_1G_2G_3}{1+G_2G_4+G_1G_2G_3H}$$

2.

$$\frac{Y}{X}(s)=\frac{G_3}{1+G_3} \qquad \frac{Y}{R}(s)=\frac{G_1G_2G_3}{(1+G_1G_2)(1+G_3)+G_2G_3H} \qquad \frac{Y}{D}(s)=\frac{G_3(1+G_1G_2)}{(1+G_1G_2)(1+G_3)+G_2G_3H}$$

3.

$$\frac{B}{A}(s)=\frac{G_2}{1+G_2H_2} \qquad \frac{Y}{R}(s)=\frac{G_1G_2G_3}{1+G_2H_2+G_1G_2(1+G_3H_1)} \qquad \frac{Y}{D}(s)=\frac{G_3(1+G_2H_2)}{1+G_2H_2+G_1G_2(1+G_3H_1)}$$

4.

$$\frac{Y}{D}(s)=\frac{G_3}{1+G_3(G_1+G_4)} \qquad \frac{C}{D}(s)=\frac{G_3G_4}{1+G_3(G_1+G_4)} \qquad \frac{Y}{R}(s)=\frac{G_3(G_1+G_2)}{1+G_3(G_1+G_4)}$$

5.

$$\frac{Y}{X}(s)=\frac{G_3}{1+G_3H} \qquad \frac{Y}{R}(s)=\frac{G_1G_2G_3}{1+G_1G_2+G_2G_3+G_3H+G_1G_2G_3H} \qquad \frac{Y}{D}(s)=\frac{G_3(1+G_1G_2)}{1+G_1G_2+G_2G_3+G_3H+G_1G_2G_3H}$$