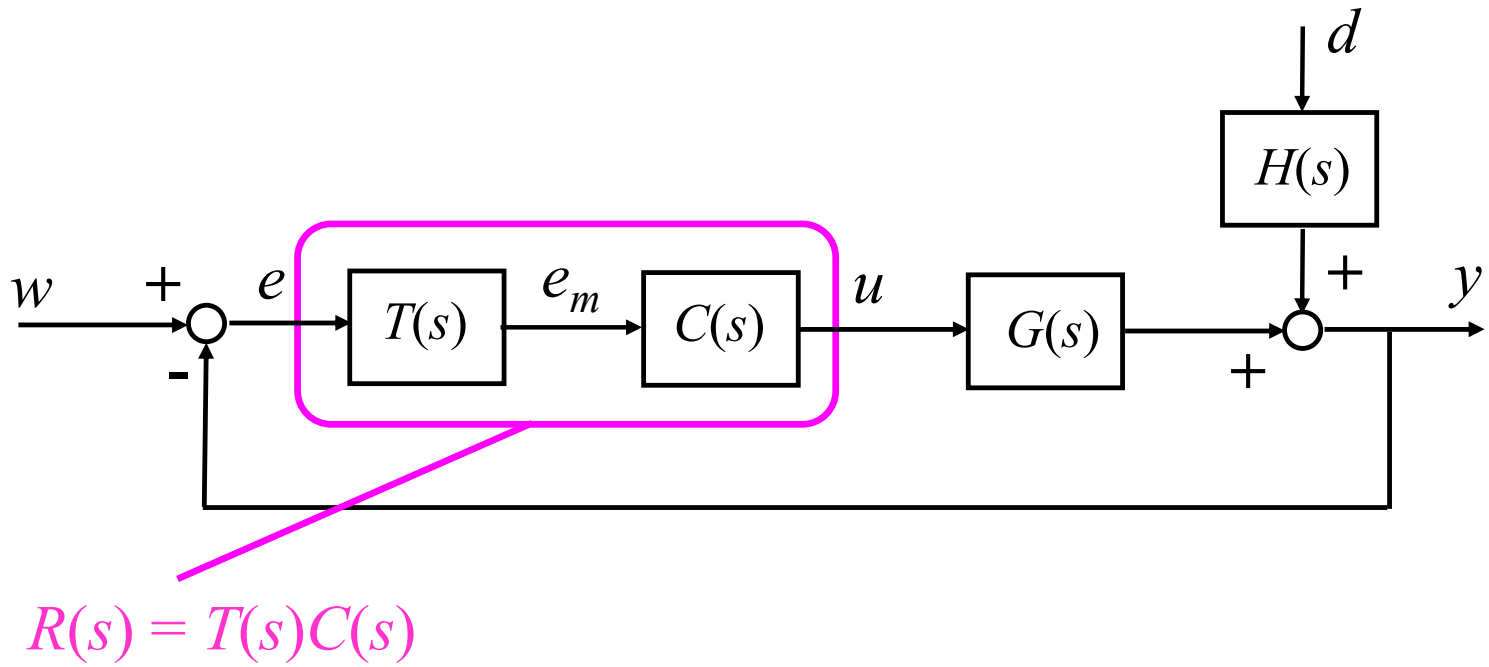
Lezione 16. Analisi delle prestazioni di sistemi retroazionati (a)

Introduzione

Schema

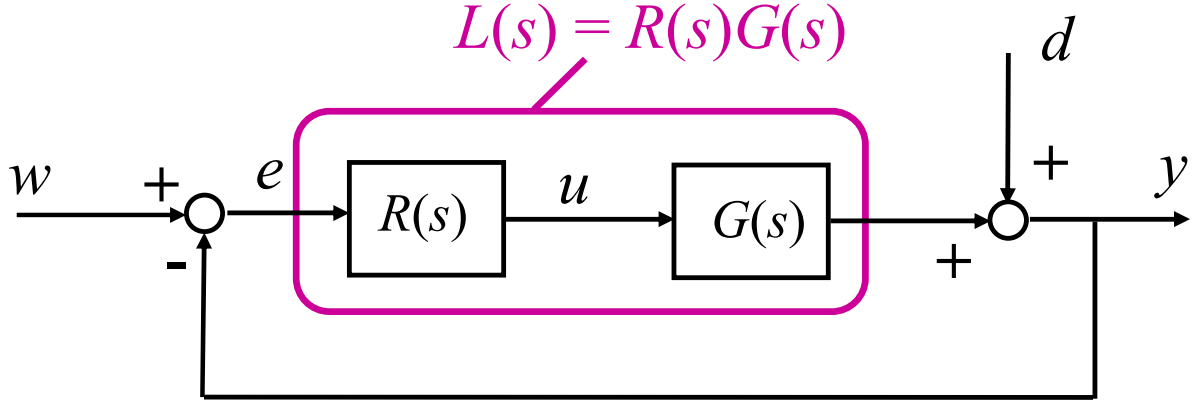
1. Funzioni di trasferimento in anello chiuso
2. Funzioni di sensitività
3. Rappresentazioni equivalenti
4. Esempio

1. Funzioni di trasferimento in anello chiuso



$R(s) = T(s)C(s)$

per il momento supponiamo $H(s) = 1$

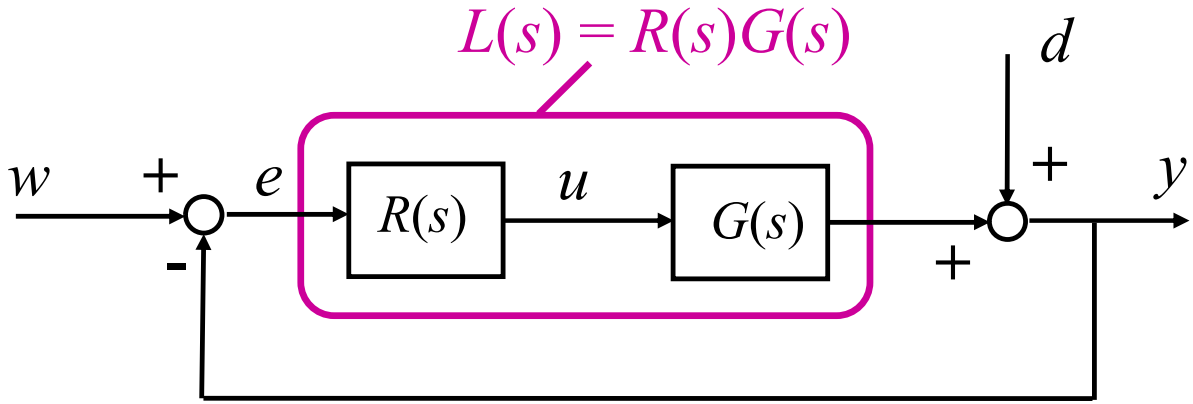


$$\frac{Y(s)}{W(s)} = \frac{L(s)}{1+L(s)} = F(s) \qquad \frac{Y(s)}{D(s)} = \frac{1}{1+L(s)} = S(s)$$

$$\frac{E(s)}{W(s)} = \frac{1}{1+L(s)} = S(s) \qquad \frac{E(s)}{D(s)} = \frac{-1}{1+L(s)} = -S(s)$$

$$\frac{U(s)}{W(s)} = \frac{R(s)}{1+L(s)} = Q(s) \qquad \frac{U(s)}{D(s)} = \frac{-R(s)}{1+L(s)} = -Q(s)$$

2. Funzioni di sensitività



$$F(s) = \frac{L(s)}{1 + L(s)}$$

funzione di sensitività complementare

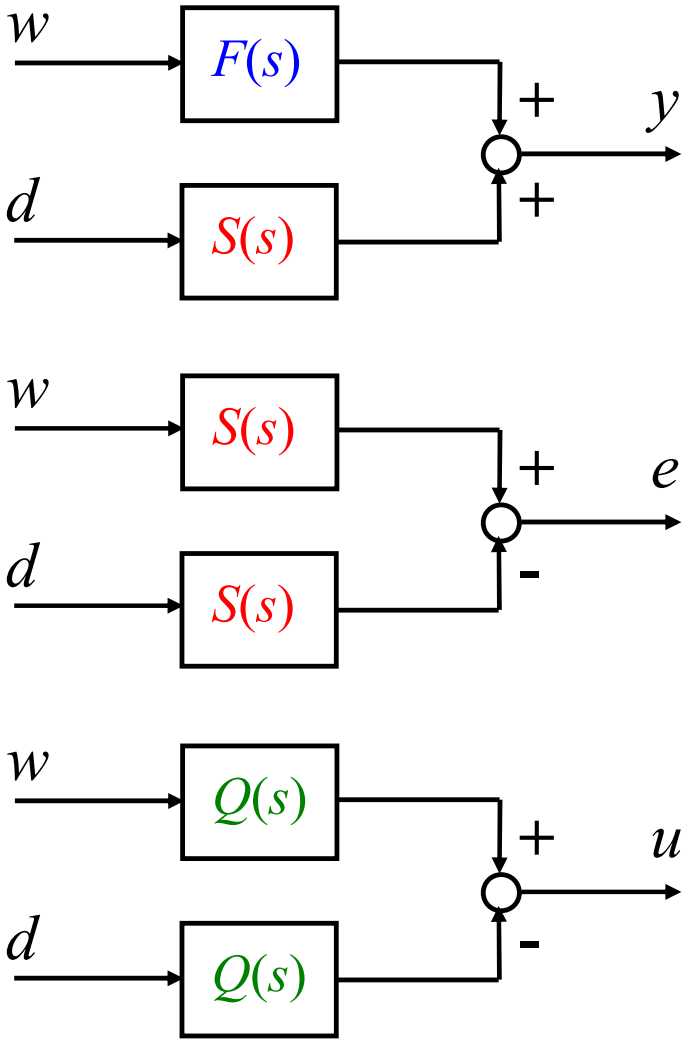
$$S(s) = \frac{1}{1 + L(s)}$$

funzione di sensitività

$$Q(s) = \frac{R(s)}{1 + L(s)}$$

funzione di sensitività del controllo

3. Rappresentazioni equivalenti



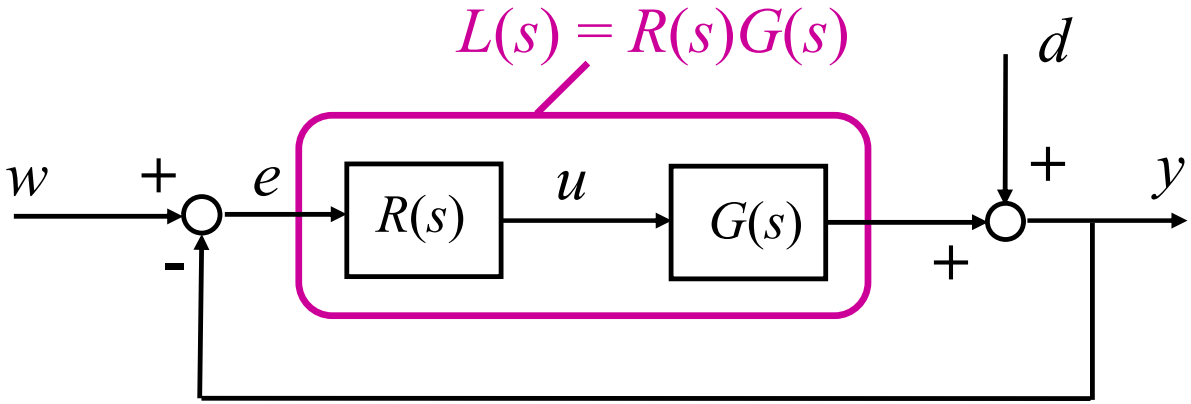
prestazioni ideali

$$F(s) = \frac{L(s)}{1+L(s)} \qquad \sim 1$$

$$S(s) = \frac{1}{1+L(s)} \qquad \sim 0$$

$$Q(s) = \frac{R(s)}{1+L(s)} \qquad \sim 0$$

Esempio



$$R(s) = \frac{10}{s}$$

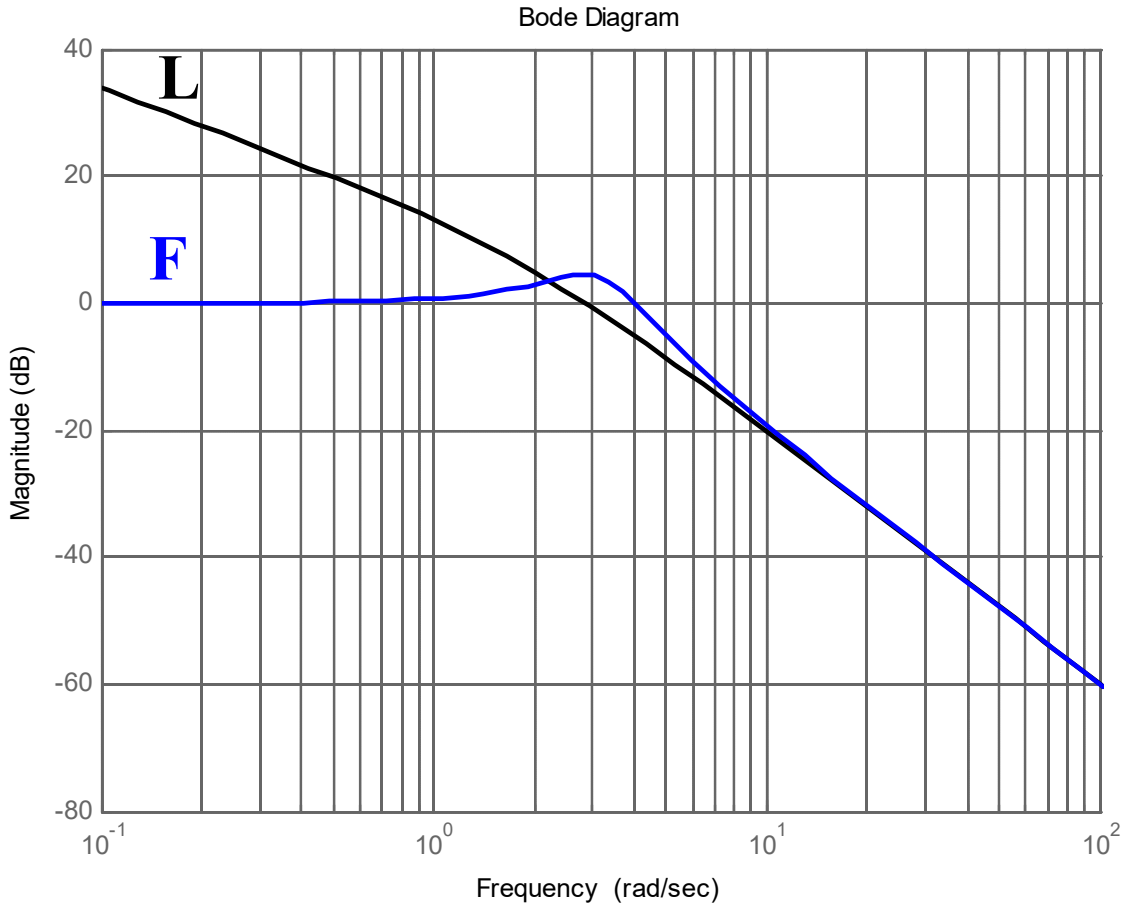
$$G(s) = \frac{1}{s+2}$$

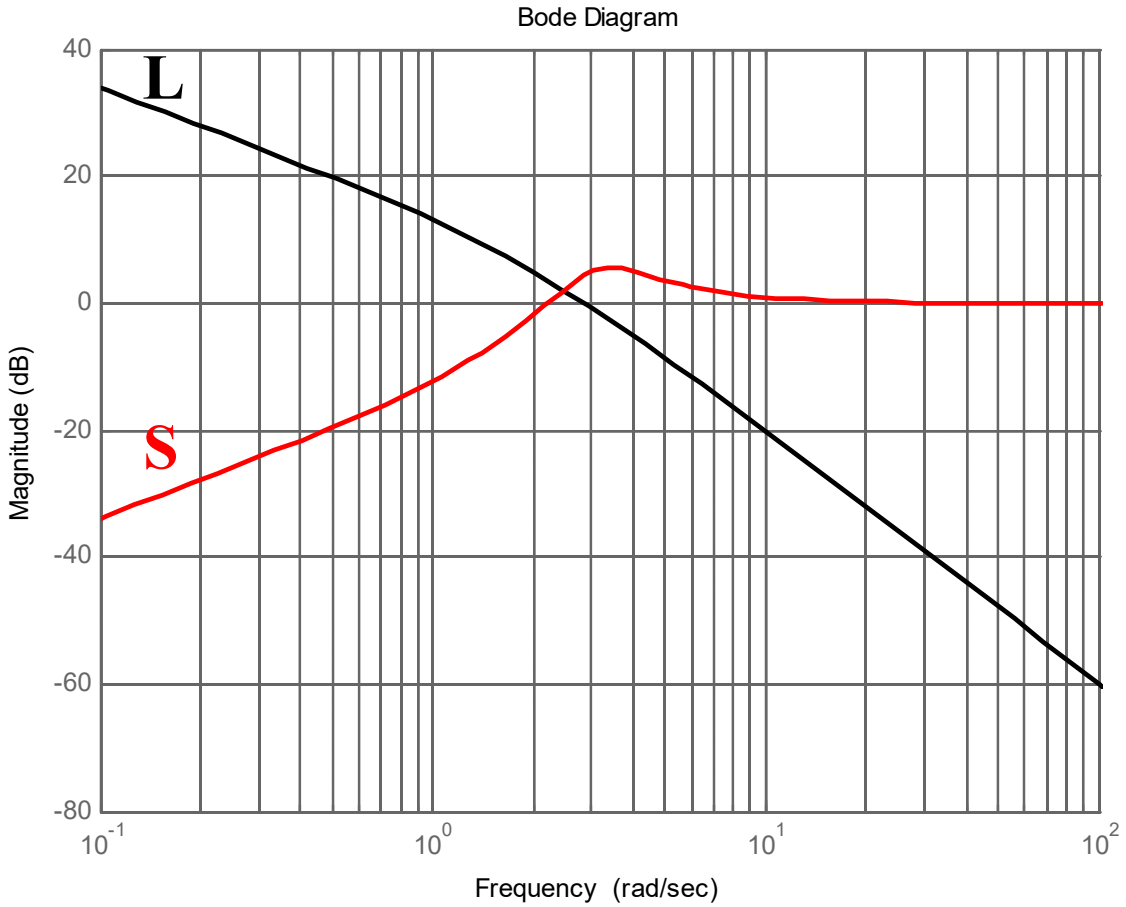
$$\Rightarrow \quad L(s) = R(s)G(s) = \frac{10}{s(s+2)}$$

$$F(s) = \frac{L(s)}{1+L(s)} = \frac{\dfrac{10}{s(s+2)}}{1+\dfrac{10}{s(s+2)}} = \frac{10}{s^2+2s+10}$$

$$S(s) = \frac{1}{1+L(s)} = \frac{1}{1+\dfrac{10}{s(s+2)}} = \frac{s(s+2)}{s^2+2s+10}$$

$$Q(s) = \frac{R(s)}{1+L(s)} = \frac{\dfrac{10}{s}}{1+\dfrac{10}{s(s+2)}} = \frac{10(s+2)}{s^2+2s+10}$$


Bode Diagram
L
F
40
20
0
-20
-40
-60
-80
Magnitude (dB)
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/sec)


Bode Diagram
L
S
40
20
0
-20
-40
-60
-80
Magnitude (dB)
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/sec)