

## RISPOSTA AL GRADINO

### PRIMO ORDINE A. STABILE

NO ZERI

$$G(s) = \frac{1}{1 + sT} = \frac{1}{T(s + \frac{1}{T})} = \frac{\frac{1}{T}}{s + \frac{1}{T}} \quad \text{dove } T \text{ è la costante di trasferimento } \rho$$

### SECONDO ORDINE A. STABILE

NO ZERI

$$\cos \Leftrightarrow \frac{s}{s^2 + \omega_n^2}$$

$$\sin \Leftrightarrow \frac{\omega_n}{s^2 + \omega_n^2}$$

$$G(s) = \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2} \Rightarrow Y(s) = \frac{1}{s} - \frac{s + \zeta\omega_n}{(s + \zeta\omega_n)^2 + \omega_n^2(1 - \zeta^2)} - \frac{\zeta\omega_n}{\omega_n\sqrt{1 - \zeta^2}(s + \zeta\omega_n)}$$

$$\Rightarrow y(t) = \left\{ 1 \cdot e^{-\zeta\omega_n t} \left[ \cos(\omega_d t) + \frac{\zeta\omega_n}{\omega_d} \sin(\omega_d t) \right] \right\} \cdot 1L(t)$$

### Calcolo valori risposta

Tempo Assestamento

$$T_a = \frac{4.6}{\zeta\omega_n} \frac{\pi}{\sqrt{1 - \zeta^2}}$$

Sovraelongazione percentuale

$$S\% = e^{-\frac{\pi\zeta}{\sqrt{1 - \zeta^2}}}$$

Tempo di Solito

$$T_R = \frac{1.8}{\omega_n} \quad \text{con } \zeta = 0.5$$