Esempi discretizzazione

- Discretizzazione con vari metodi e differenti Tc
- Regolatore deadbeat semplificato
- Progetto secondo Dahlin
- Risposta armonica sistema discretizzato

Funzione continua (red): $G(s) := \frac{1}{(s+1)(s+10)}$

Tempi di campionamento: 0.05, 0.1, 0.3 sec

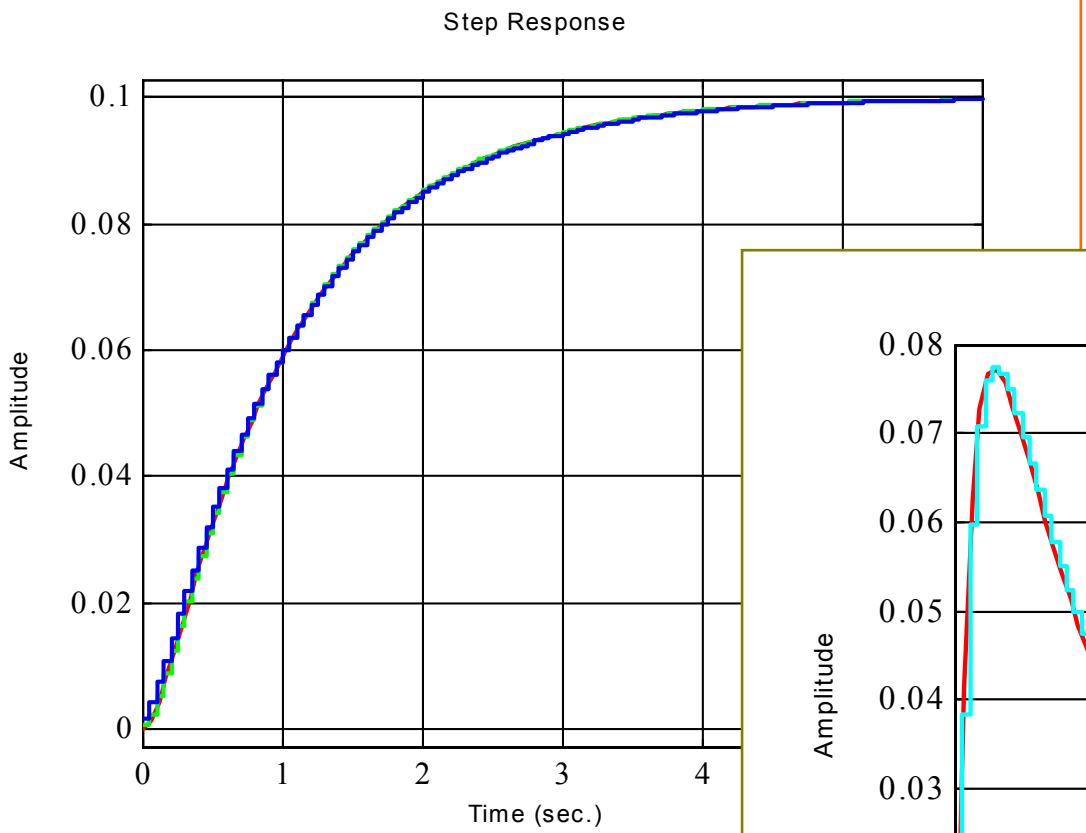
Metodi: Tustin (green) $s = \frac{2}{T_c}\frac{1-z^{-1}}{1+z^{-1}}$

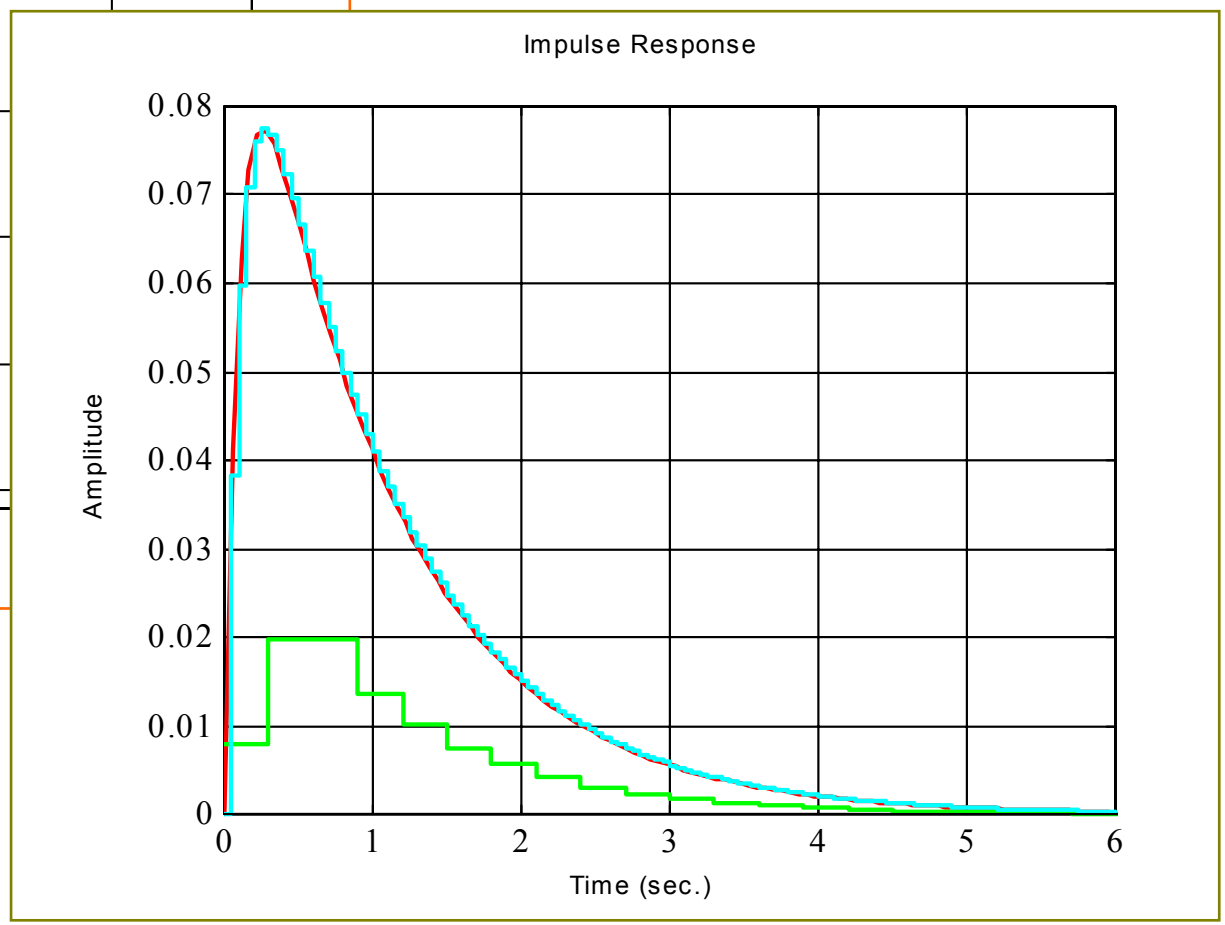
Differenze all'indietro (blu) $s = \frac{1-z^{-1}}{T_c}$

Esatto (cyan) $Z\left[L^{-1}\{G(s)\}\right]$

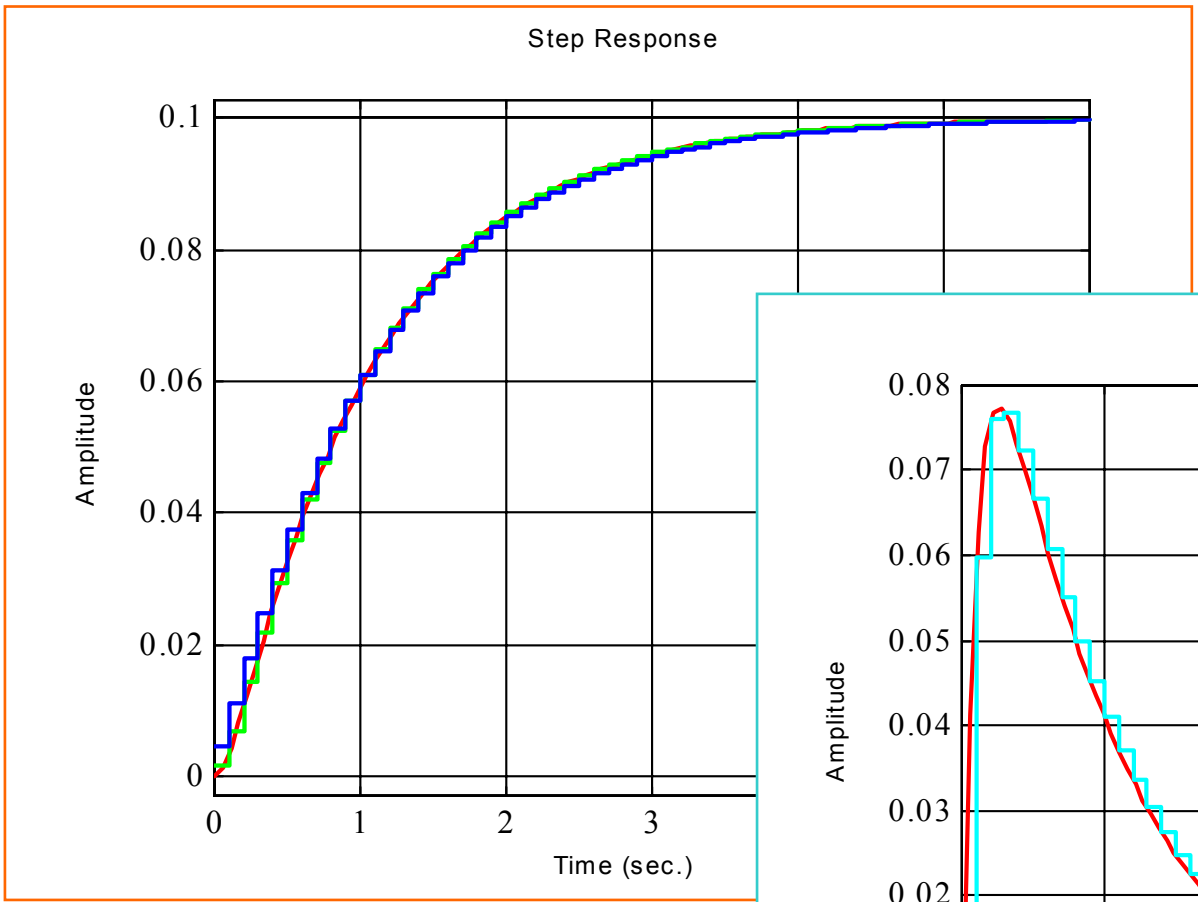
Zoh (magenta) $(1-z^{-1})Z\left[L^{-1}\left\{\frac{G(s)}{s}\right\}\right]$

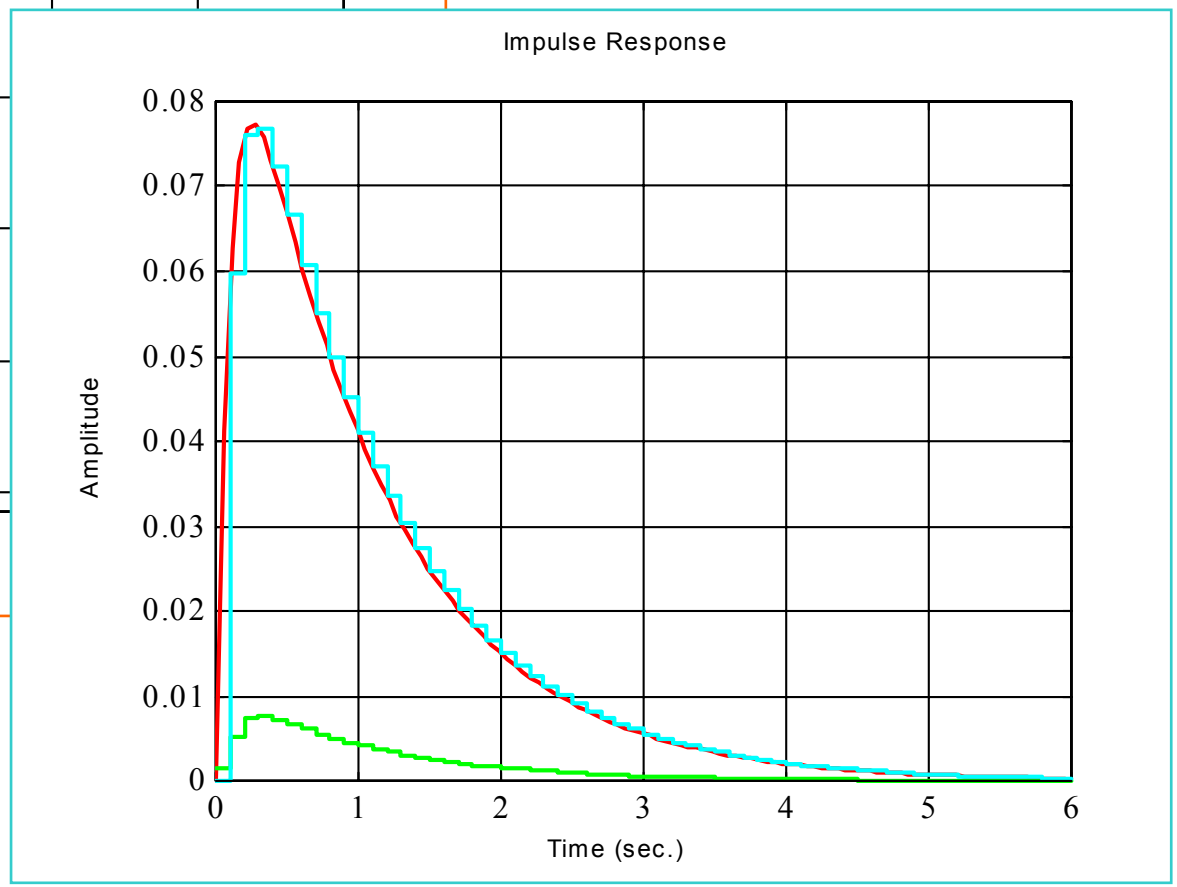
Risposta al Gradino e Impulsiva con Tc=0.05



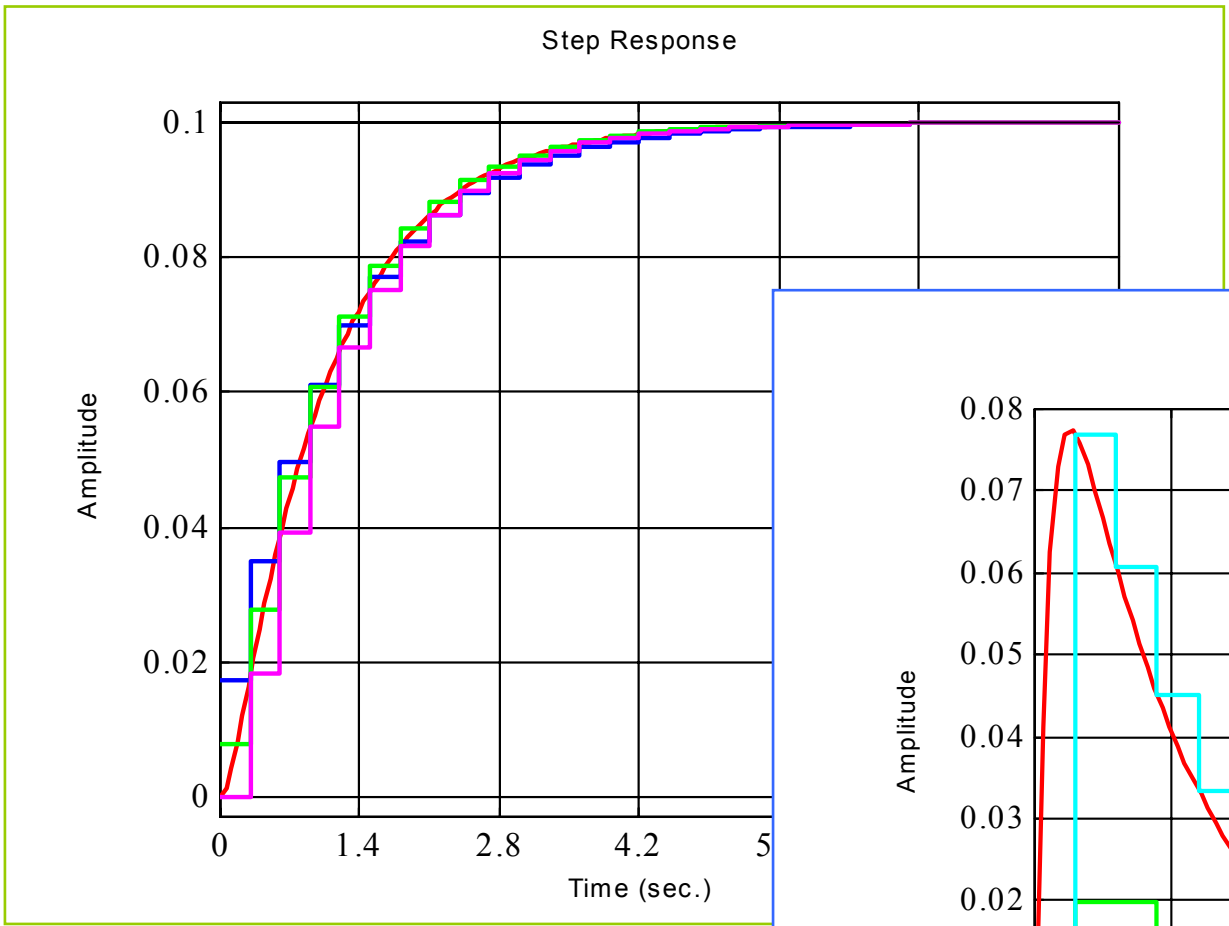


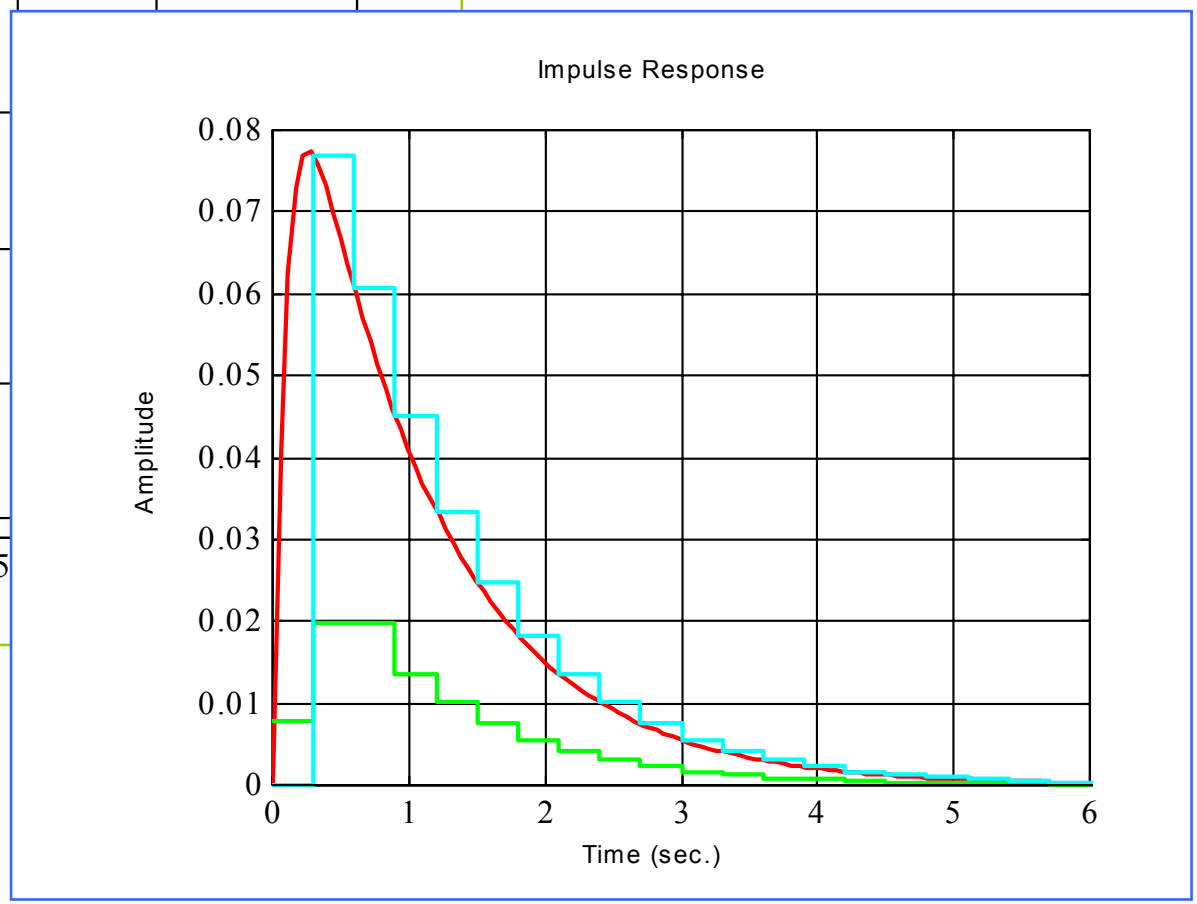
Risposta al Gradino e Impulsiva con Tc=0.1





Risposta al Gradino e Impulsiva con Tc=0.3





Processo:

$$G(s) = \frac{1}{(0.5s+1)(s+1)^2(2s+1)}$$

Discr. con Zoh:

Tc=5 sec:

$$G(z) = \frac{0.6566\,z^3 + 0.2458\,z^2 + 0.003162\,z + 1.081e-006}{z^4 - 0.09561\,z^3 + 0.001156\,z^2 - 3.779e-006\,z + 1.692e-010}$$

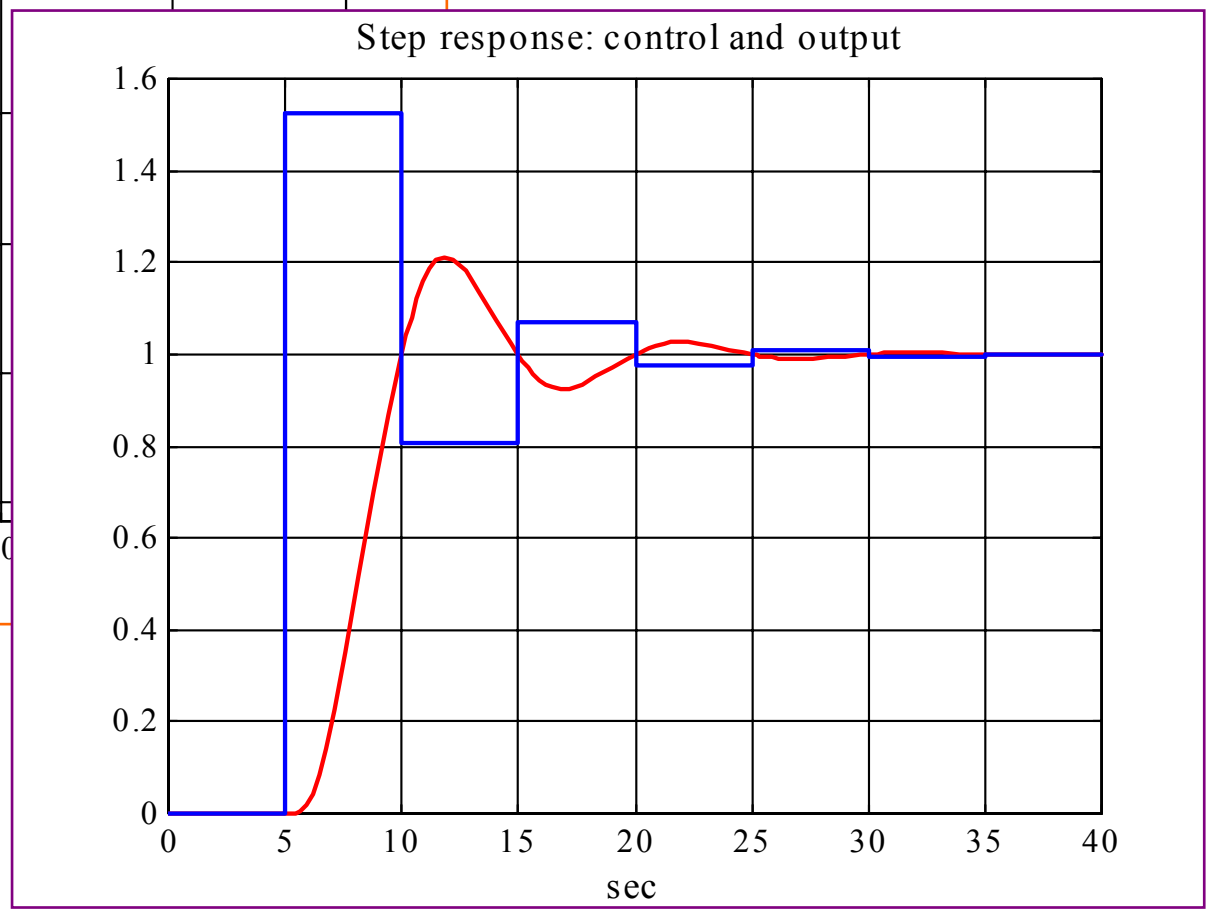
Tc=3.5 sec:

$$G(z) = \frac{0.4057\,z^3 + 0.3543\,z^2 + 0.01634\,z + 3.417e-005}{z^4 - 0.2351\,z^3 + 0.01162\,z^2 - 0.0001689\,z + 1.445e-007}$$

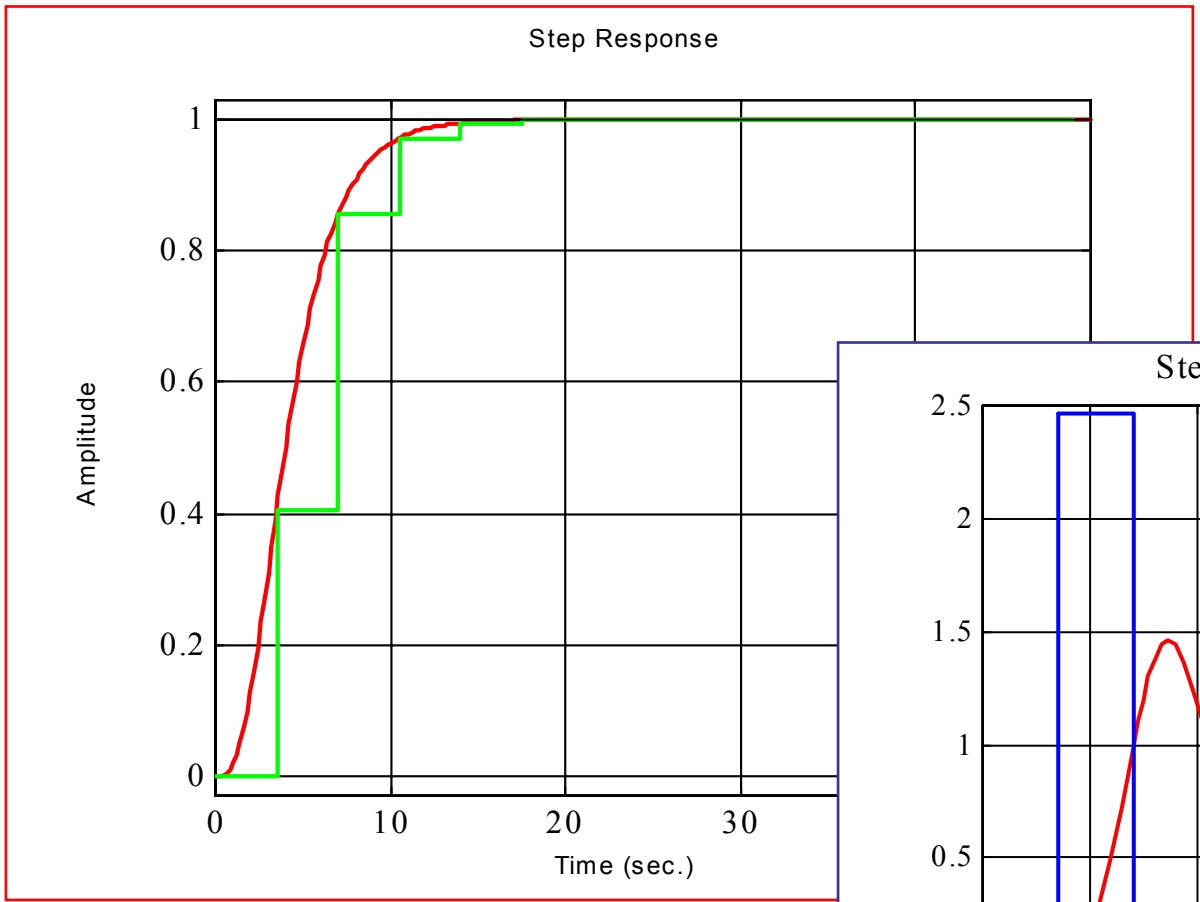
W(z) desiderata=z^{-1}

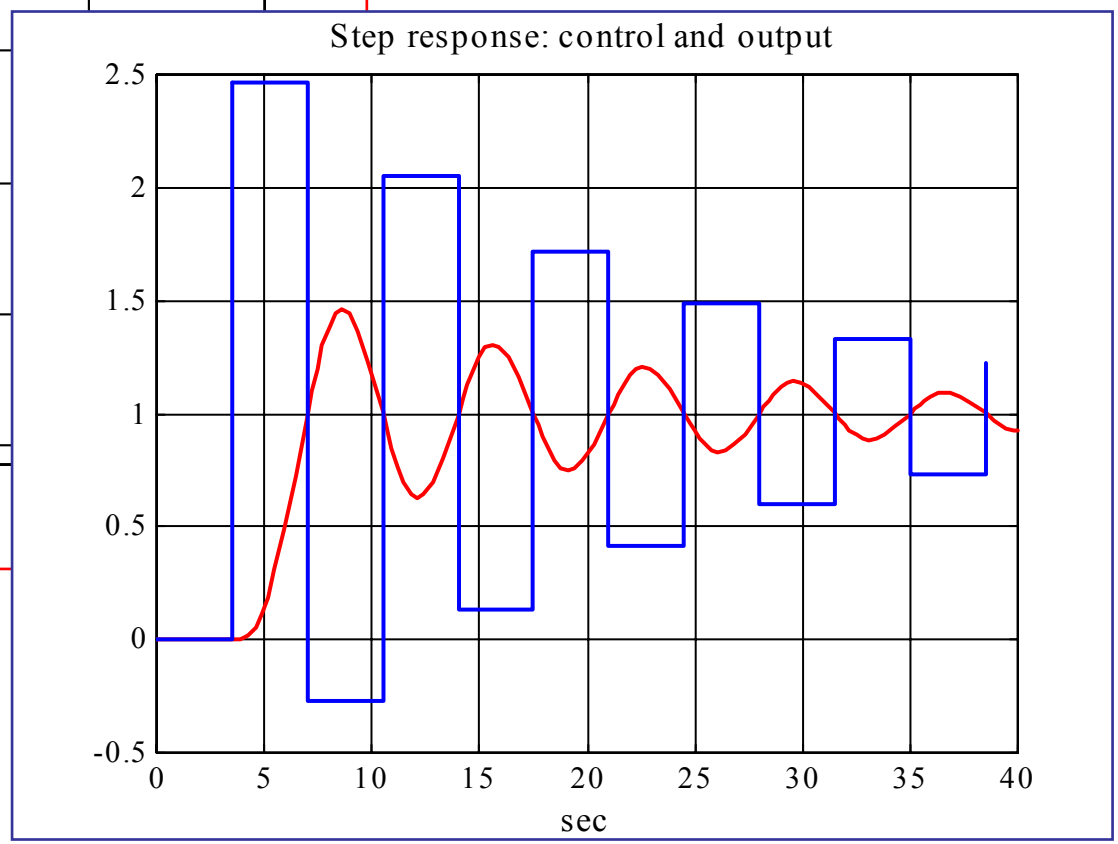
Tc=5 sec


Step Response
Amplitude
1
0.8
0.6
0.4
0.2
0
0
10
20
Time (sec.)


Step response: control and output
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
35
40
sec

Tc=3.5 sec


Step Response
Amplitude
Time (sec.)
0
0.2
0.4
0.6
0.8
1
0
10
20
30


Step response: control and output
sec
-0.5
0
0.5
1
1.5
2
2.5
0
5
10
15
20
25
30
35
40

Processo:

$$G(s) = \frac{1}{(0.5s+1)(s+1)^2(2s+1)}$$

Uscita desiderata:

$$Y(s) = \frac{e^{-\theta s}}{\lambda s + 1}\frac{1}{s}$$

per l'ingresso:

$$V(z) = \frac{1}{1 - z^{-1}}$$

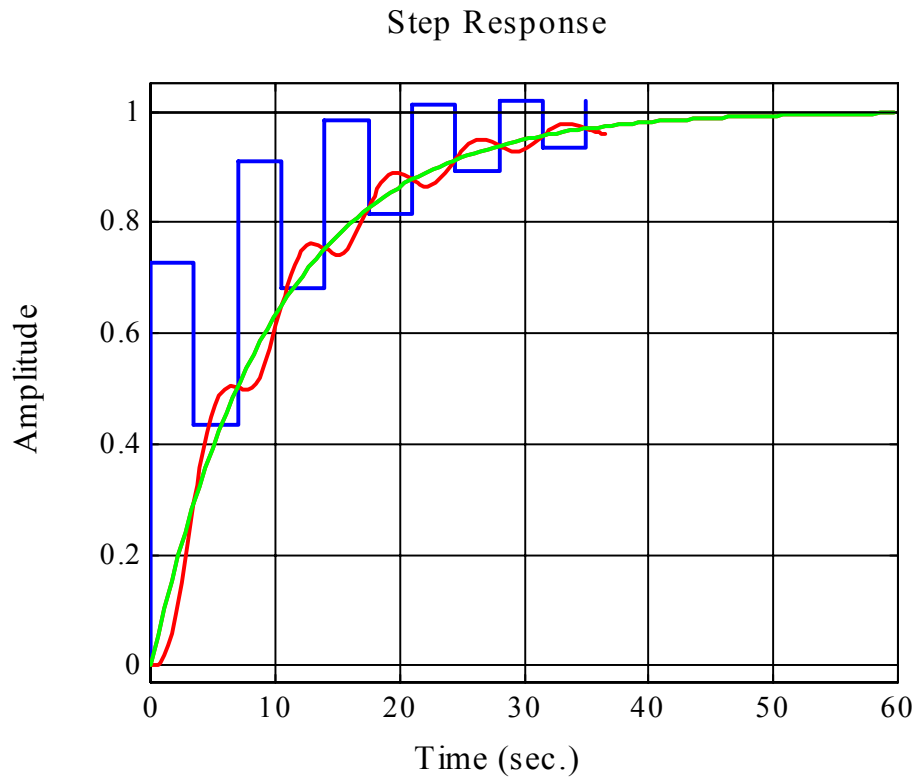
A ciclo chiuso:

$$G_m(z) = \frac{Y(z)}{V(z)}$$

Regolatore:

$$R(z) = \frac{1}{G(z)}\frac{G_m(z)}{1 - G_m(z)}$$

Parametri: λ=10, θ=0



Sistema:

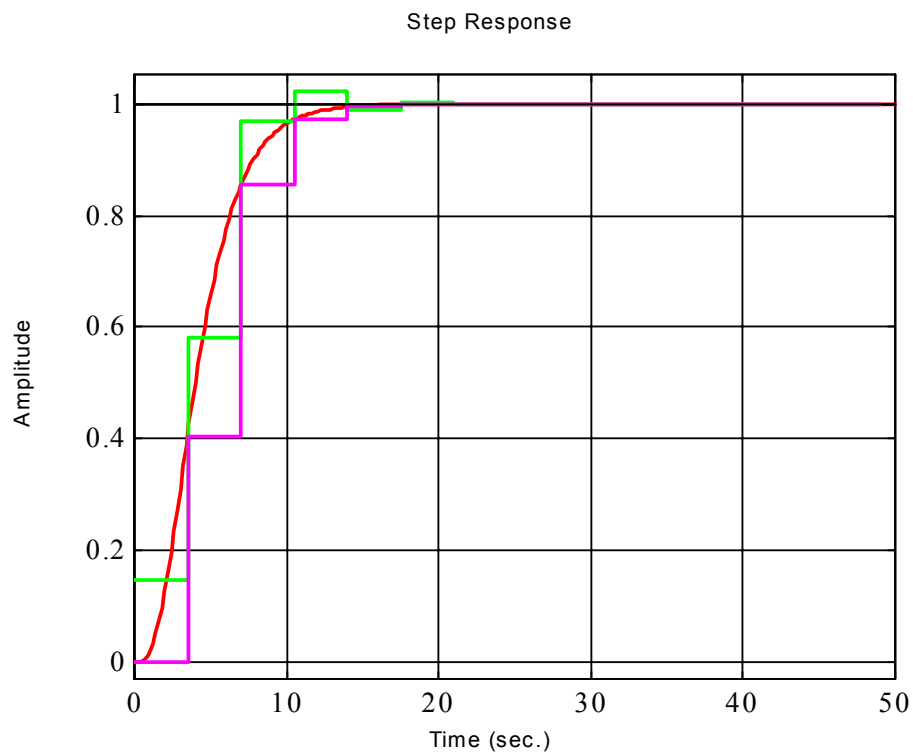
$$G(s) = \frac{1}{(0.5s+1)(s+1)^2(2s+1)}$$

T_c=3.5 sec $\omega_c/2$=0.8976 rad/sec

Discretizzazione:

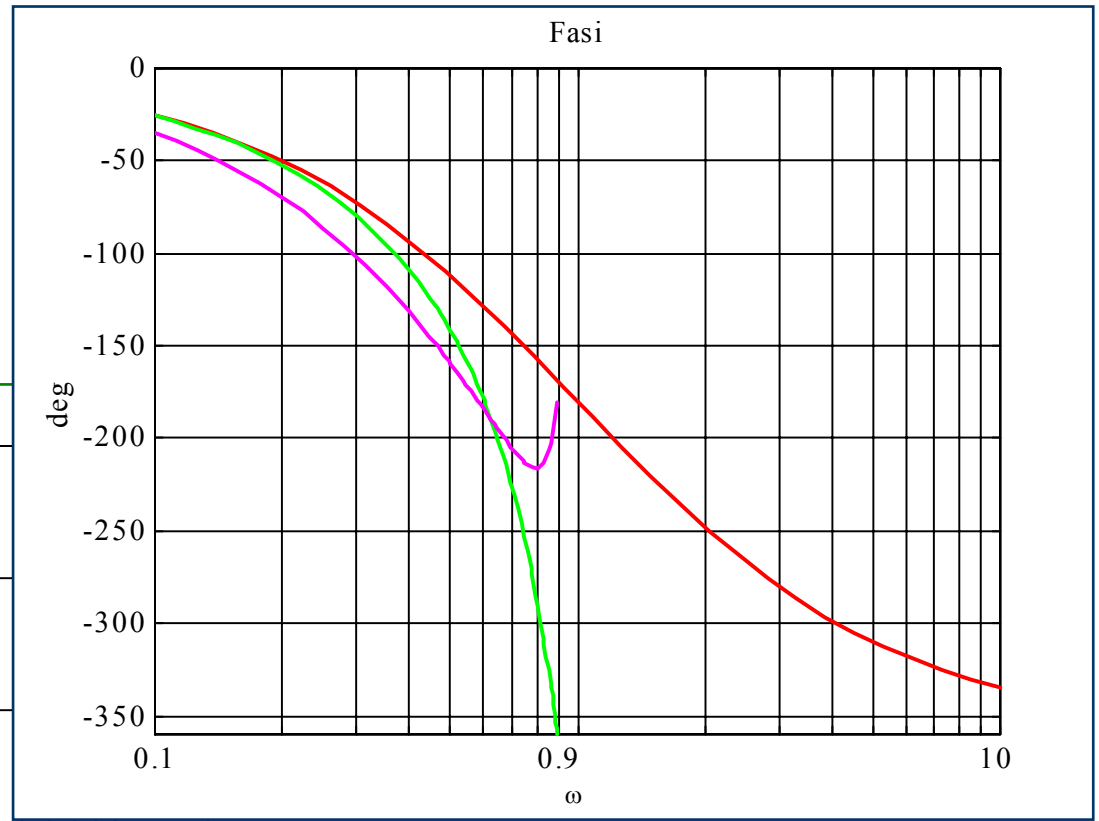
-Tustin

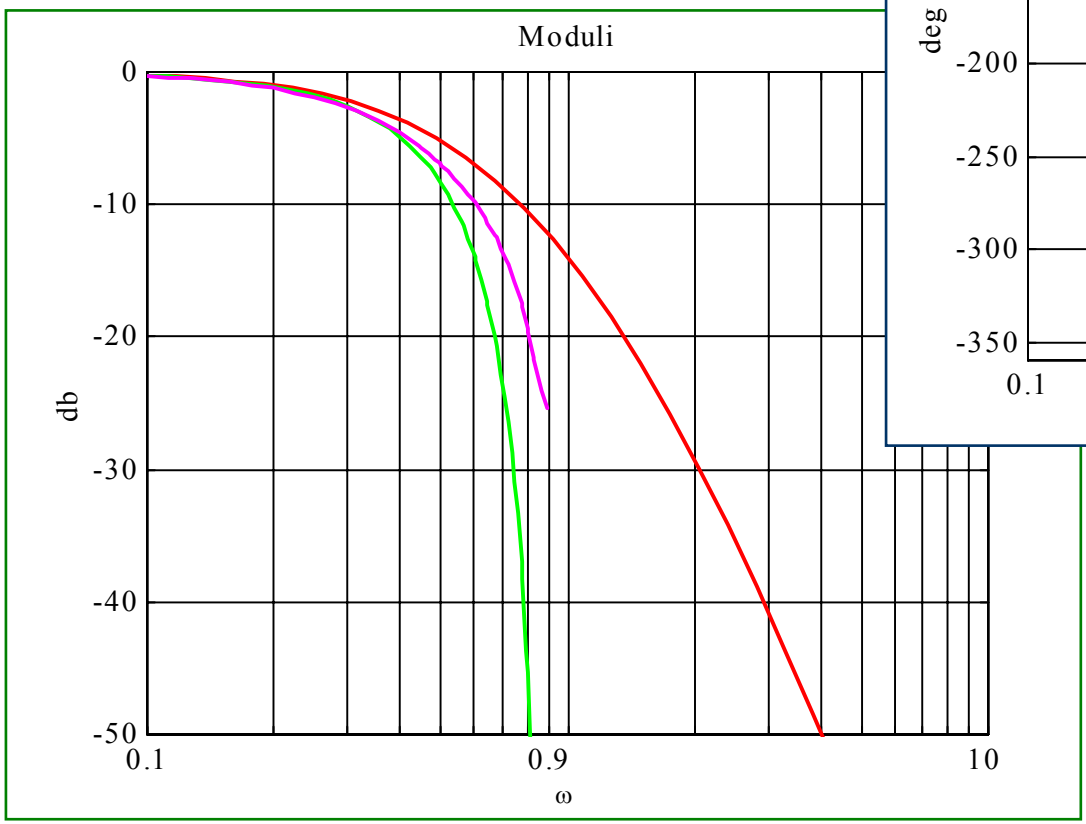
-Zoh



Risposta armonica: diagrammi

Fasi





Moduli