

Tracciamento di diagrammi di Bode

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Forma di Bode

$$G(s) = \frac{\mu \prod_i (1 + s\tau_i) \prod_i (1 + 2\zeta_i s/\alpha_{ni} + s^2/\alpha_{ni}^2)}{s^g \prod_i (1 + sT_i) \prod_i (1 + 2\xi_i s/\omega_{ni} + s^2/\omega_{ni}^2)}$$

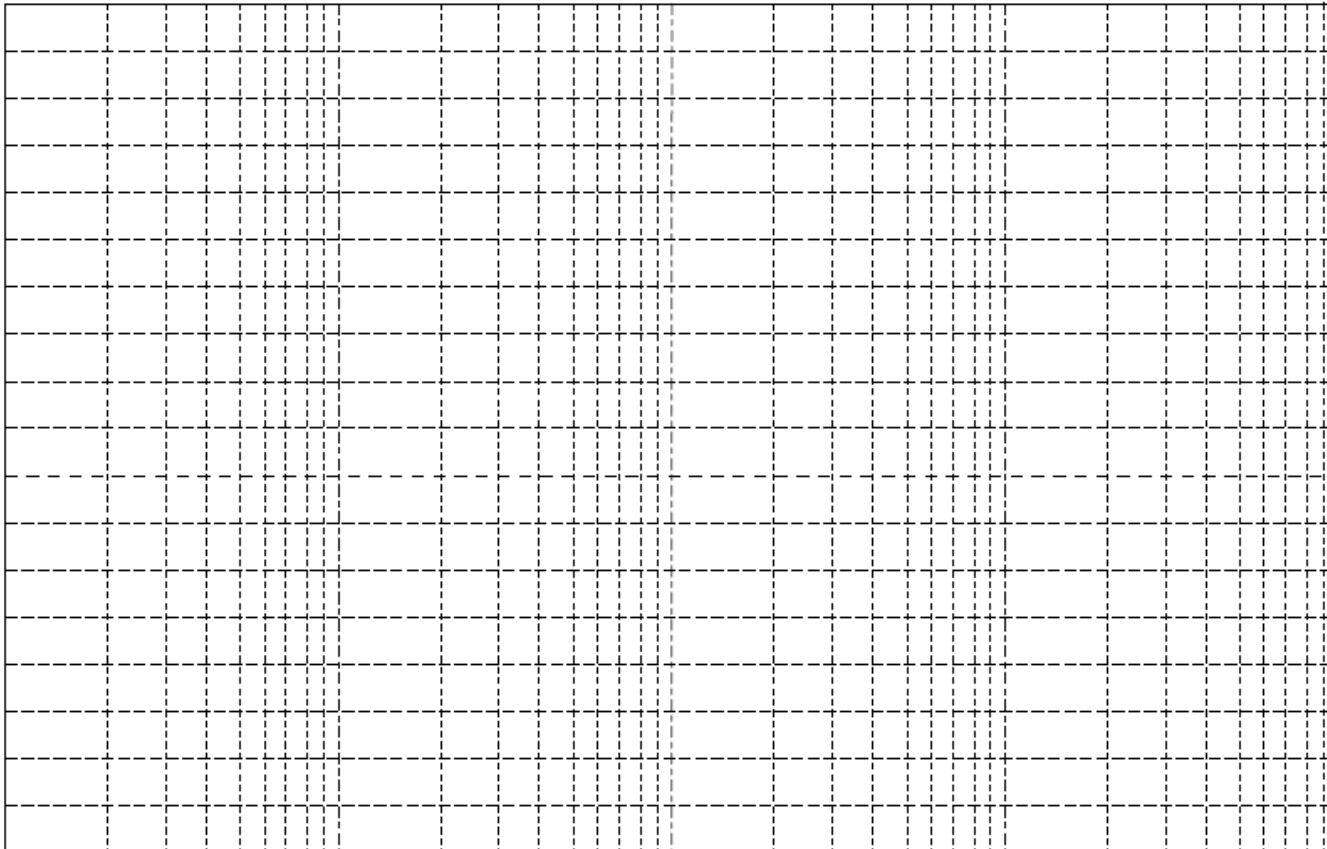
$$G(j\omega) = \frac{\mu \prod_i (1 + j\omega\tau_i) \prod_i (1 - \omega^2/\alpha_{ni}^2 + 2j\zeta_i\omega/\alpha_{ni})}{(j\omega)^g \prod_i (1 + j\omega T_i) \prod_i (1 - \omega^2/\omega_{ni}^2 + 2j\xi_i\omega/\omega_{ni})}$$



Carta semilogaritmica



Politecnico di Milano
Dipartimento di Elettronica e Informazione

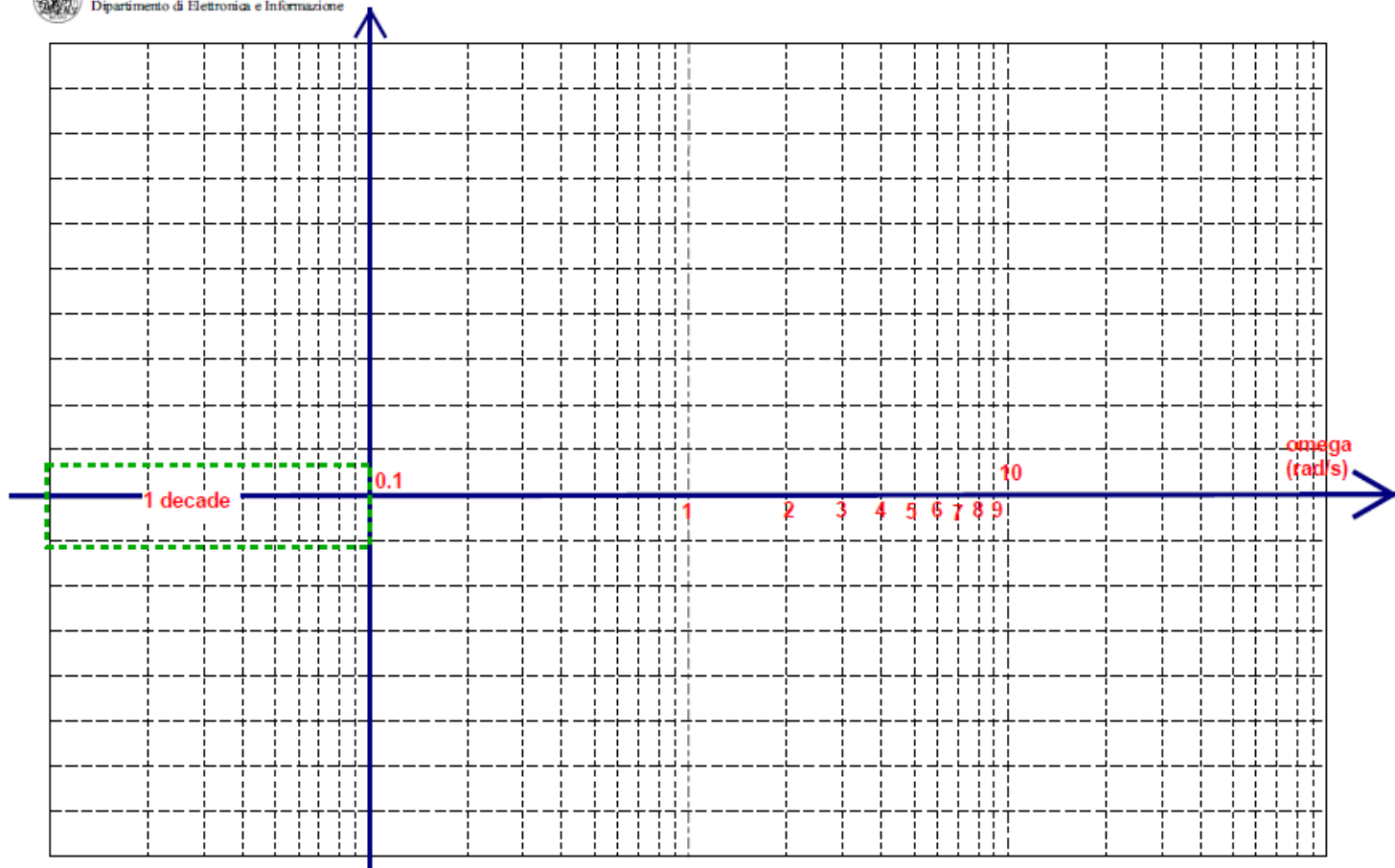




Carta semilogaritmica



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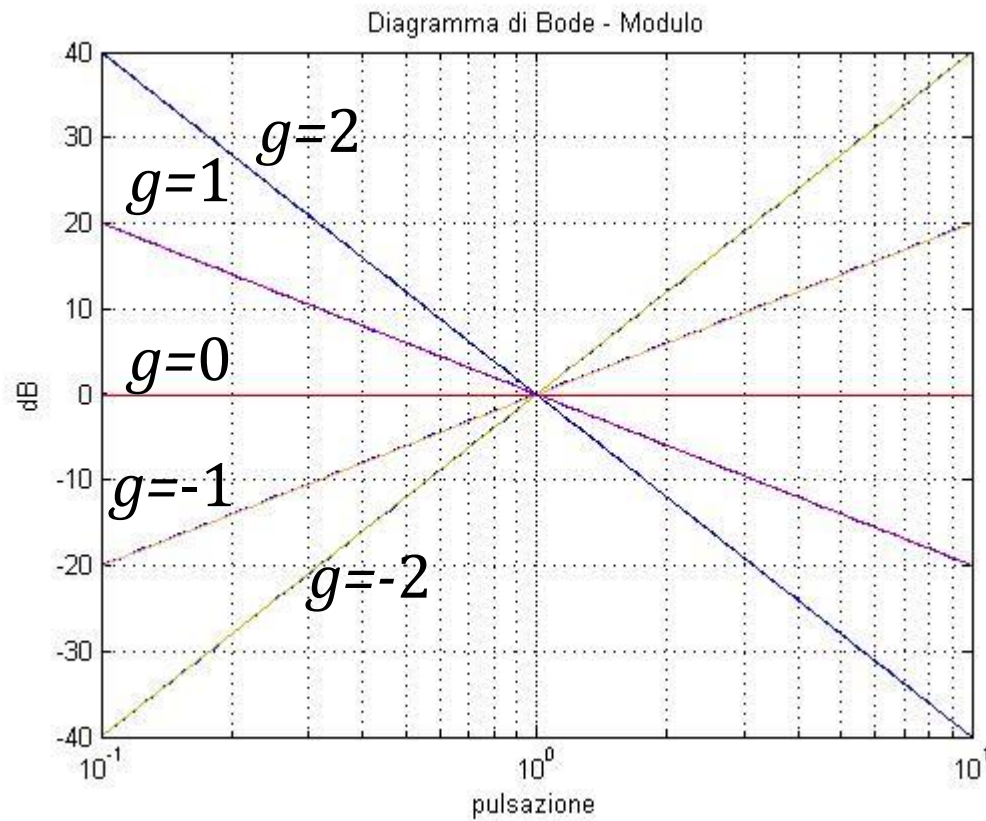


Diagrammi del modulo

$$\begin{aligned} |G(j\omega)|_{dB} &= 20 \log_{10} |\mu| - 20g \log_{10} |\omega| \\ &+ \sum_i 20 \log_{10} |1 + j\omega\tau_i| - \sum_i 20 \log_{10} |1 + j\omega T_i| \\ &+ \sum_i 20 \log_{10} |1 - \omega^2/\alpha_{ni}^2 + 2j\zeta_i\omega/\alpha_{ni}| \\ &- \sum_i 20 \log_{10} |1 - \omega^2/\omega_{ni}^2 + 2j\xi_i\omega/\omega_{ni}| \end{aligned}$$

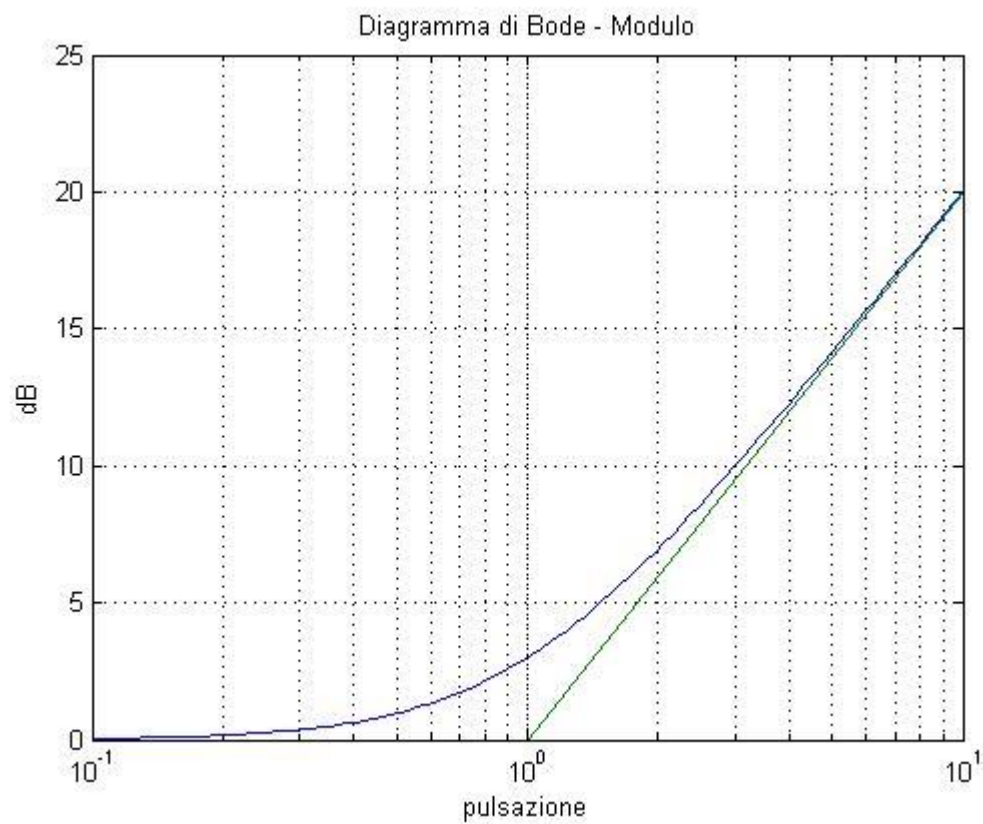


$$G(s) = \frac{1}{s^g}$$



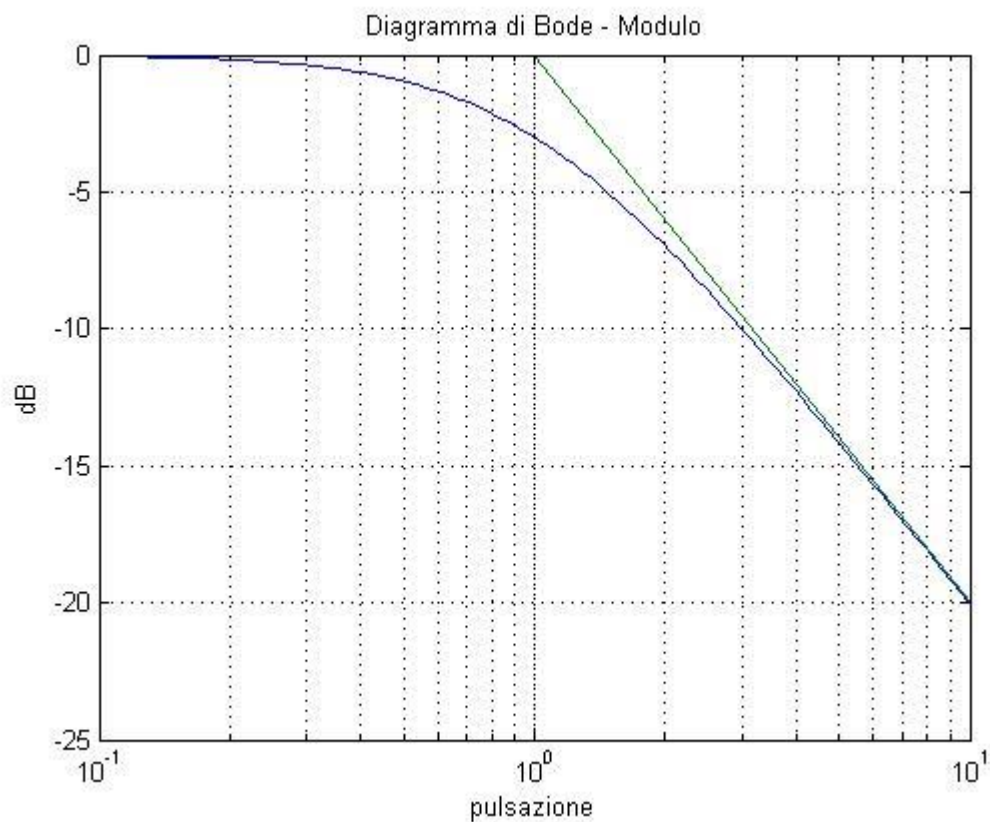


$$G(s) = 1 + s$$



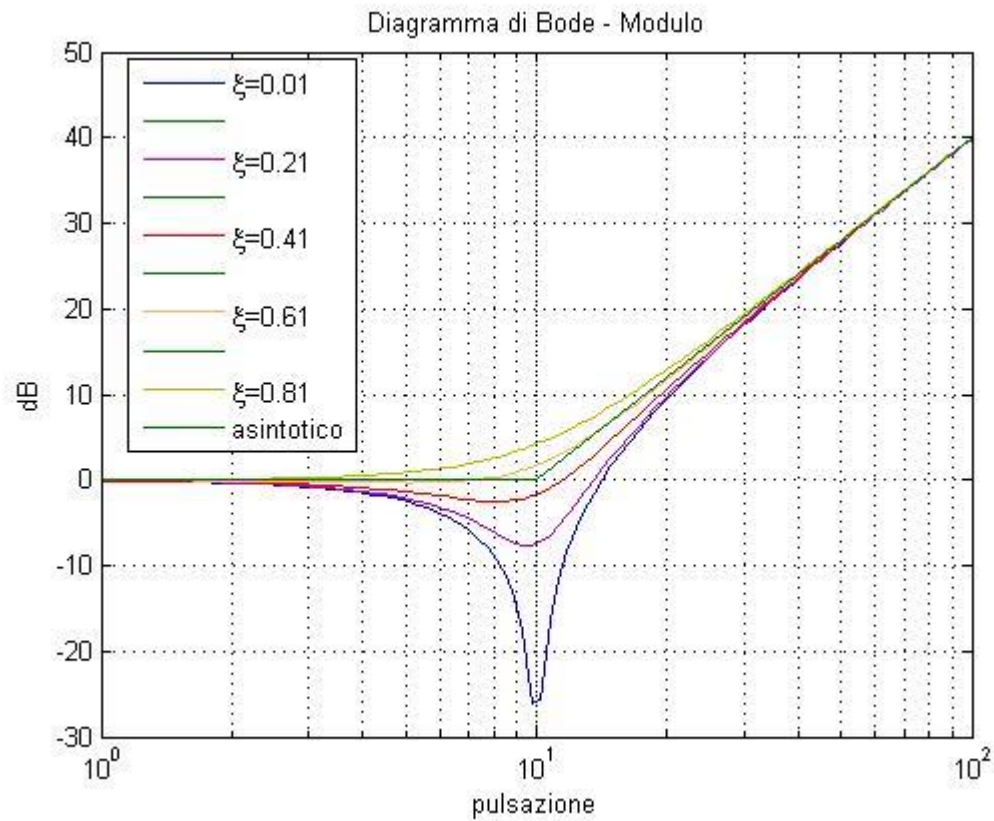


$$G(s) = \frac{1}{1 + s}$$



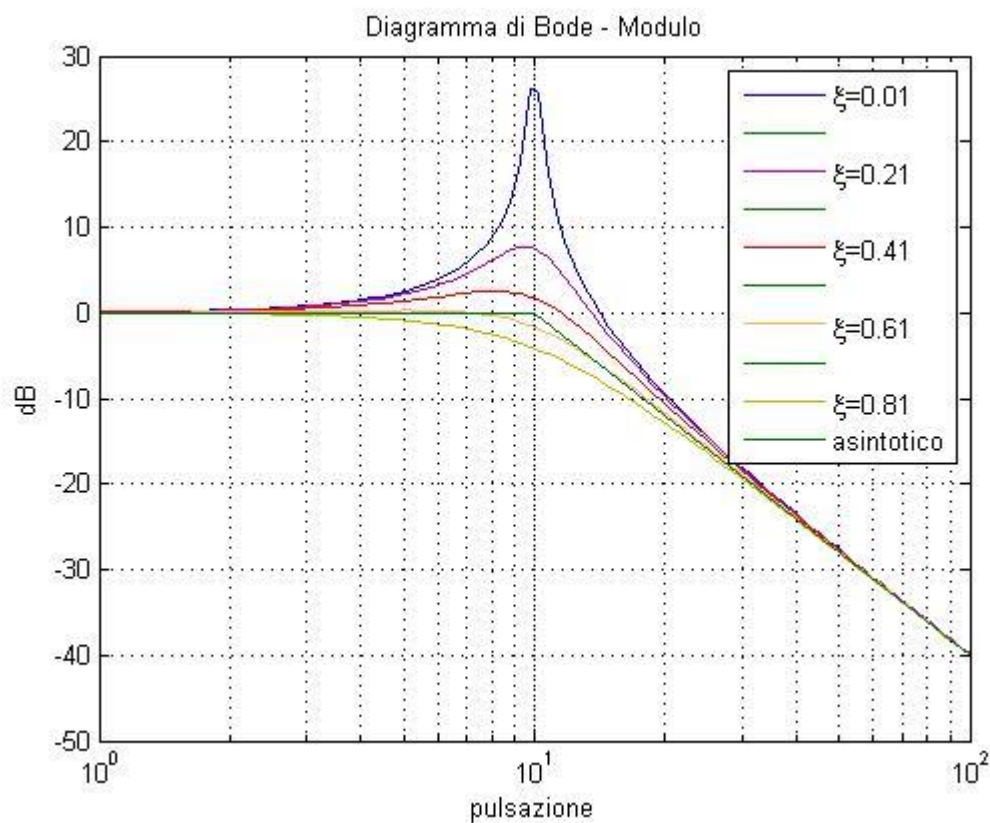


$$G(s) = 1 + \frac{2\xi s}{\omega_n} + \frac{s^2}{\omega_n^2}$$





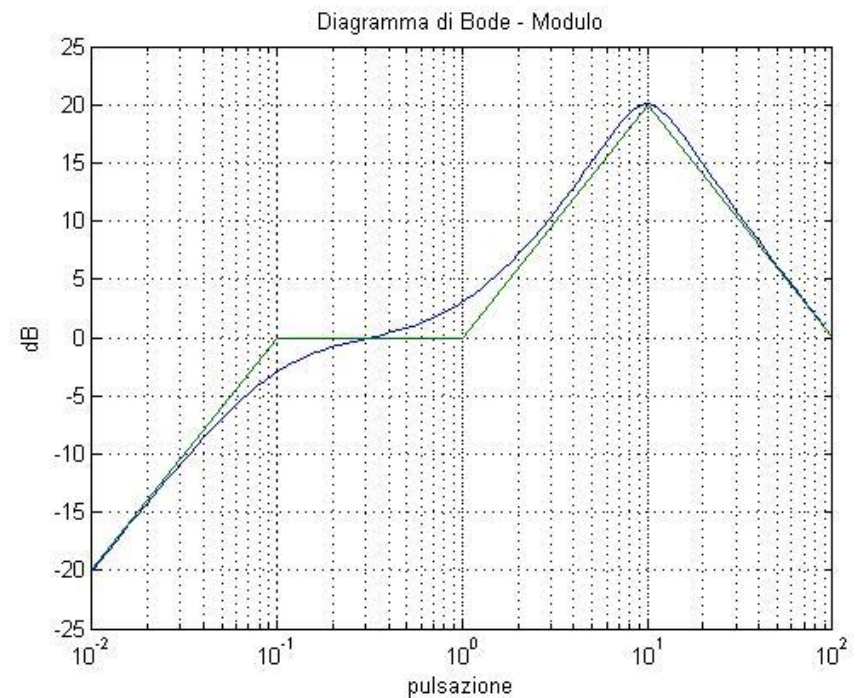
$$G(s) = \frac{1}{1 + \frac{2\xi s}{\omega_n} + \frac{s^2}{\omega_n^2}}$$





ESEMPIO

$$G(s) = \frac{-10s(1 + s)}{(1 + 10s)(1 + 0.1s + 0.01s^2)}$$



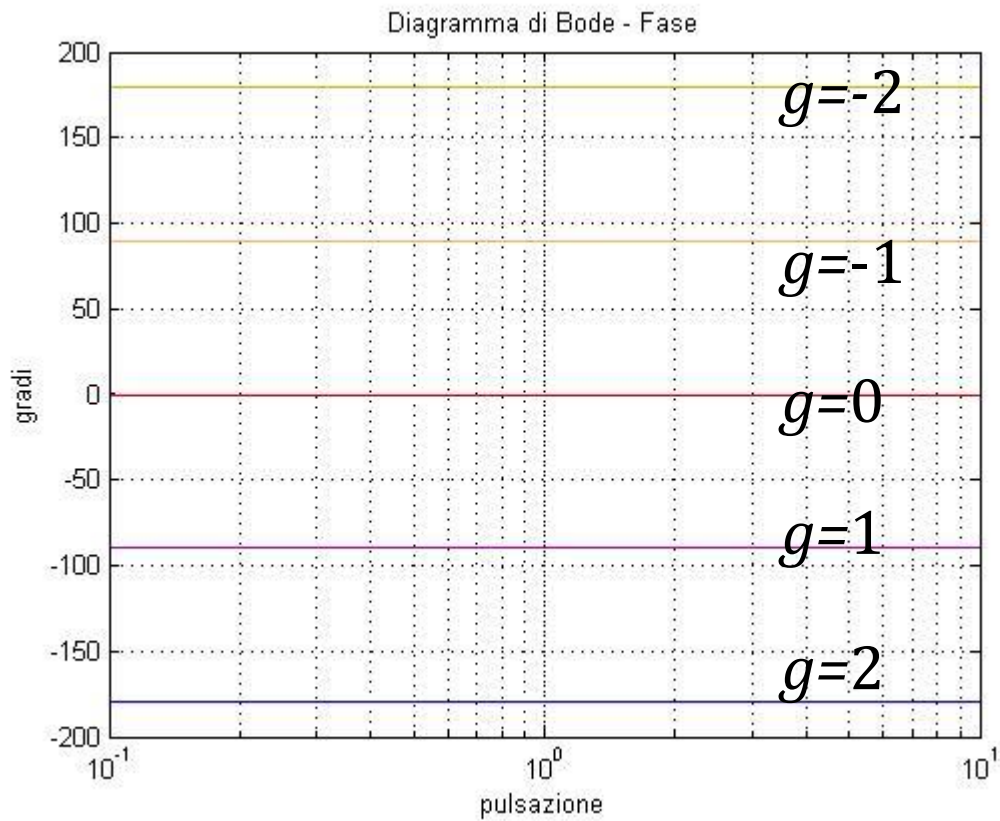


Diagrammi della fase

$$\begin{aligned}\angle G(j\omega) &= \angle(\mu) - g\angle(j\omega) \\ &+ \sum_i \angle(1 + j\omega\tau_i) - \sum_i \angle(1 + j\omega T_i) \\ &+ \sum_i \angle(1 - \omega^2/\alpha_{ni}^2 + 2j\zeta_i\omega/\alpha_{ni}) \\ &- \sum_i \angle(1 - s^2/\omega_{ni}^2 + 2j\xi_i\omega/\omega_{ni})\end{aligned}$$

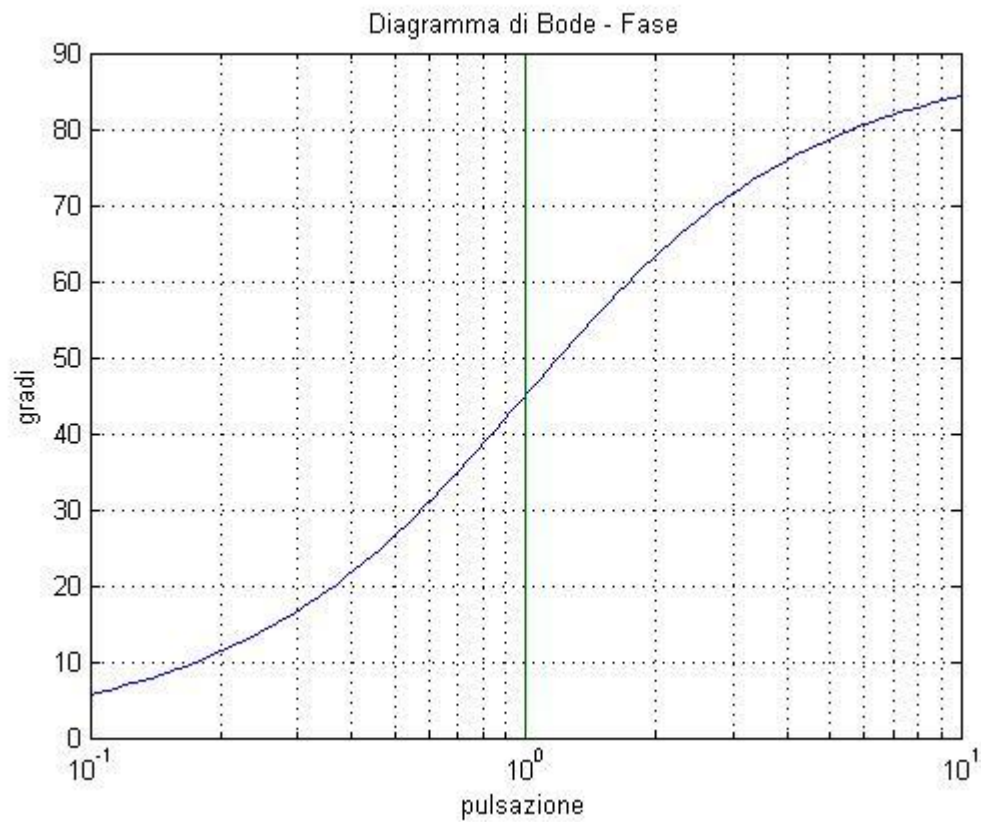


$$G(s) = \frac{1}{s^g}$$



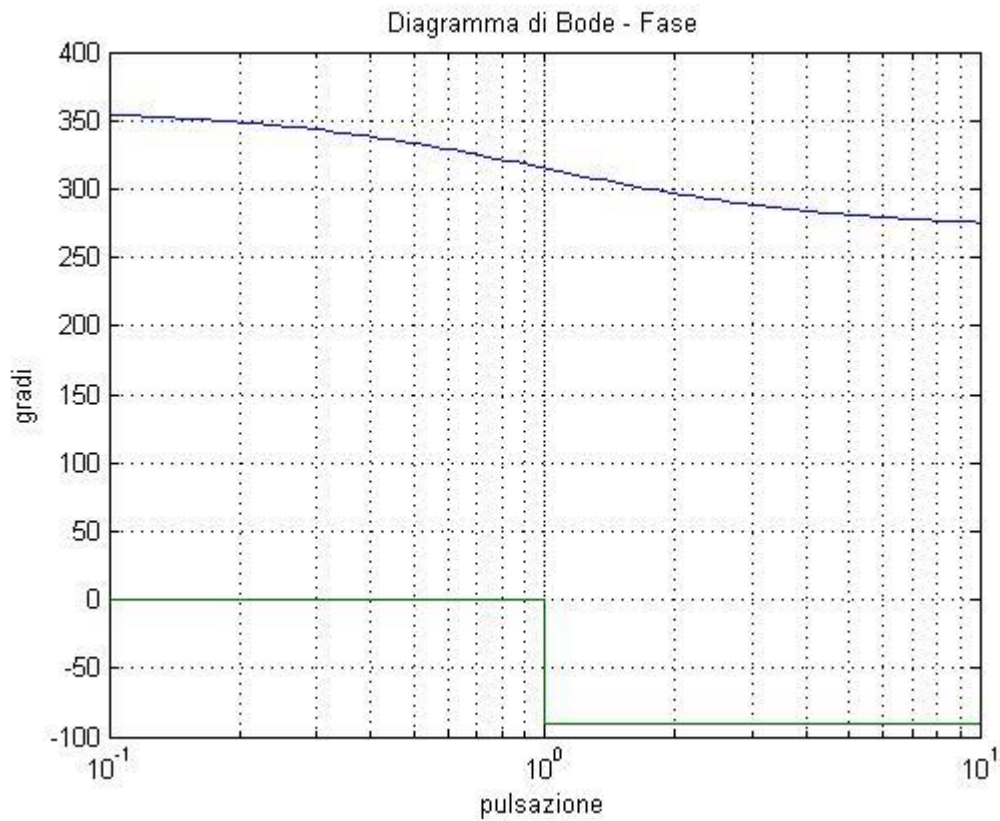


$$G(s) = 1 + s$$



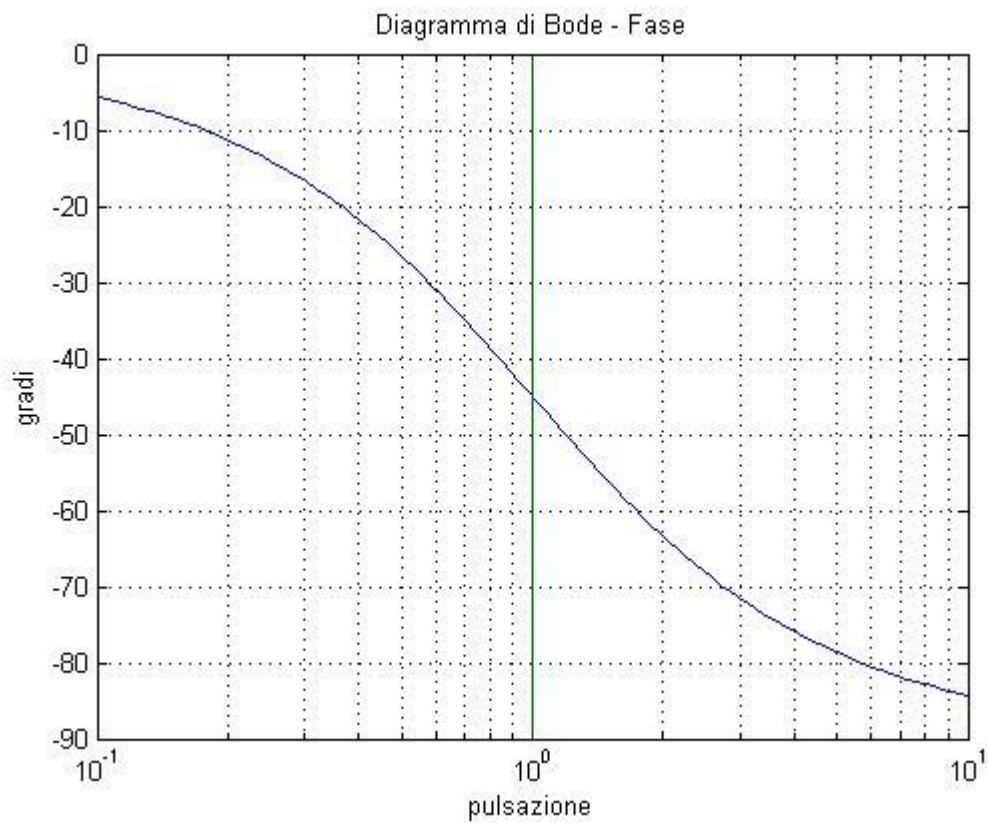


$$G(s) = 1 - s$$



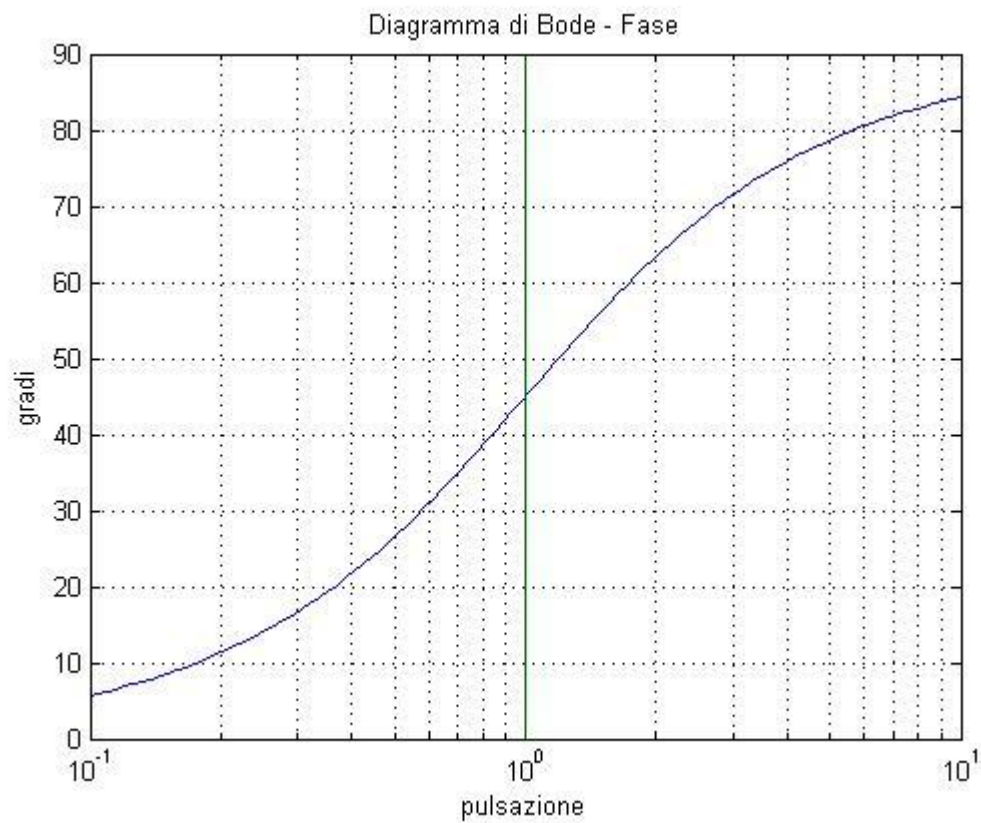


$$G(s) = \frac{1}{1 + s}$$



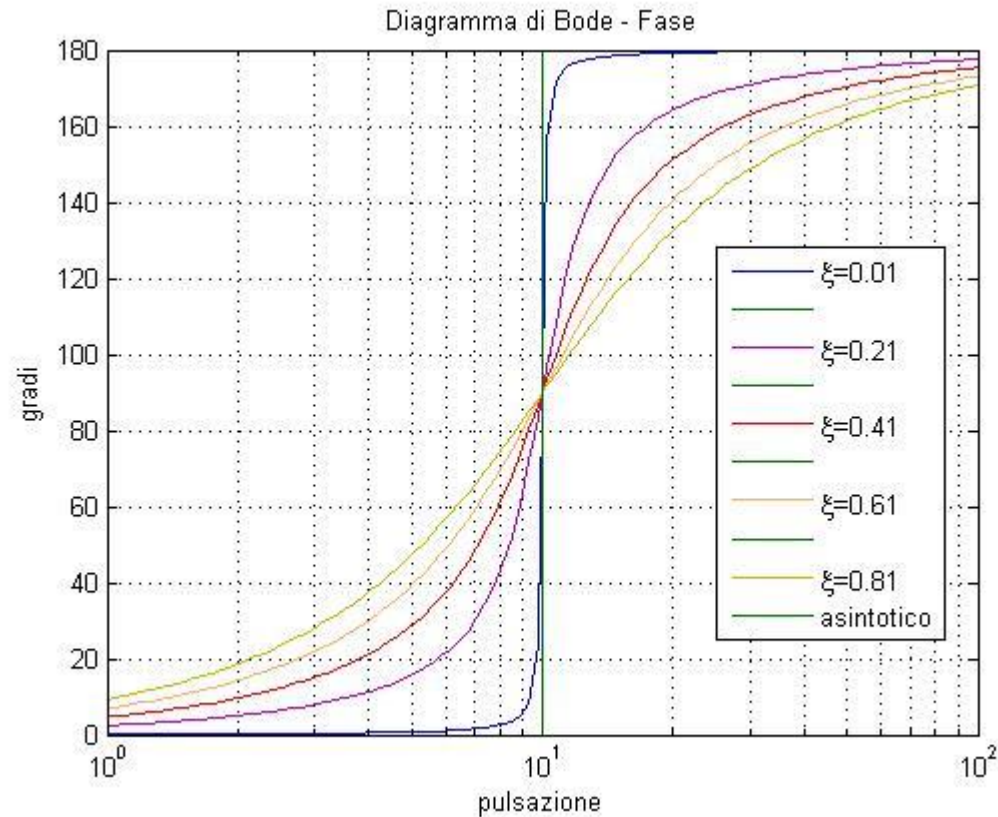


$$G(s) = \frac{1}{1 - s}$$



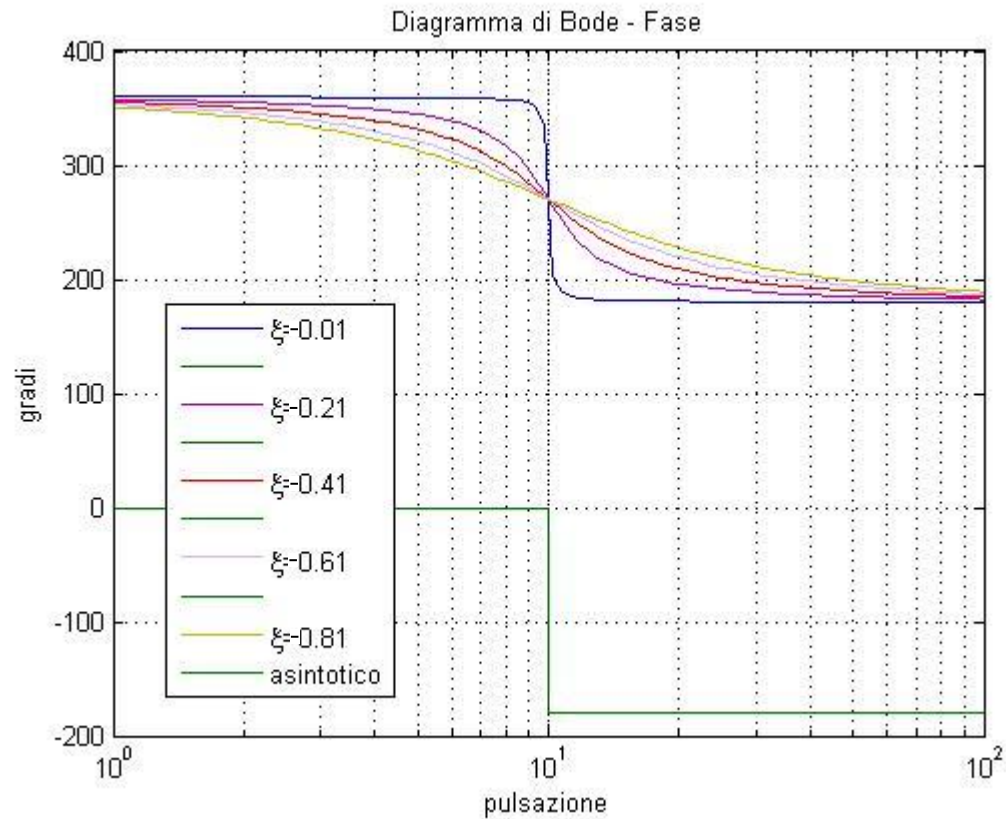


$$G(s) = 1 + \frac{2\xi s}{\omega_n} + \frac{s^2}{\omega_n^2}$$



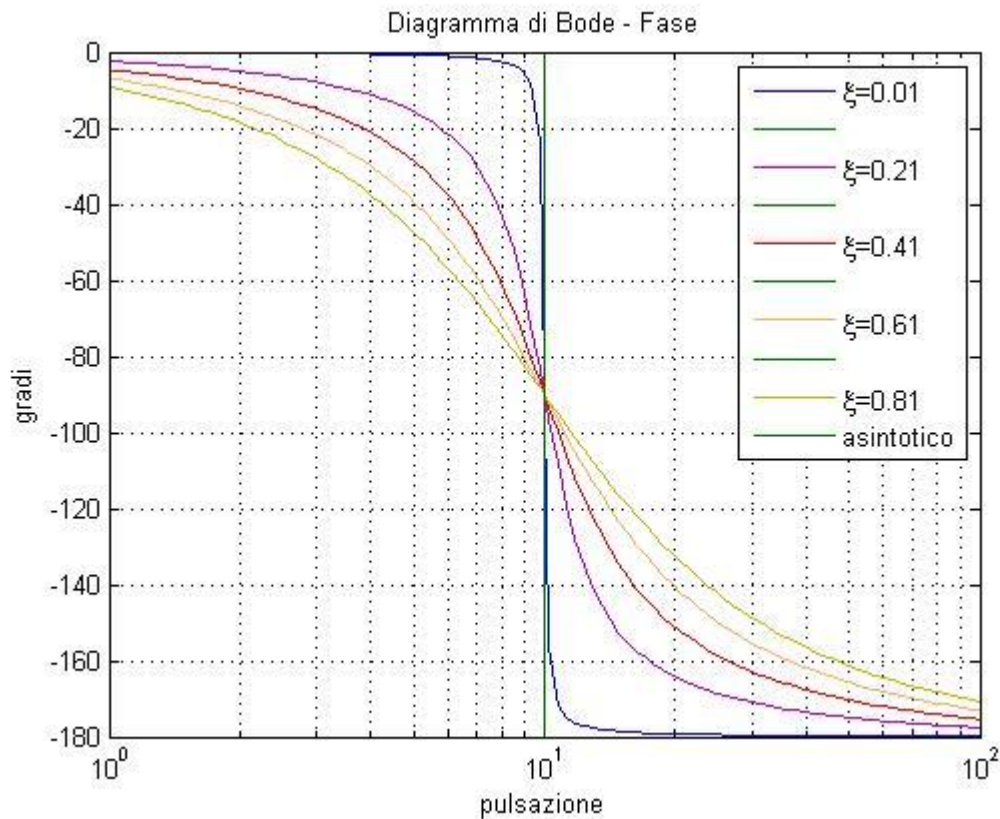


$$G(s) = 1 + \frac{2\xi s}{\omega_n} + \frac{s^2}{\omega_n^2}$$



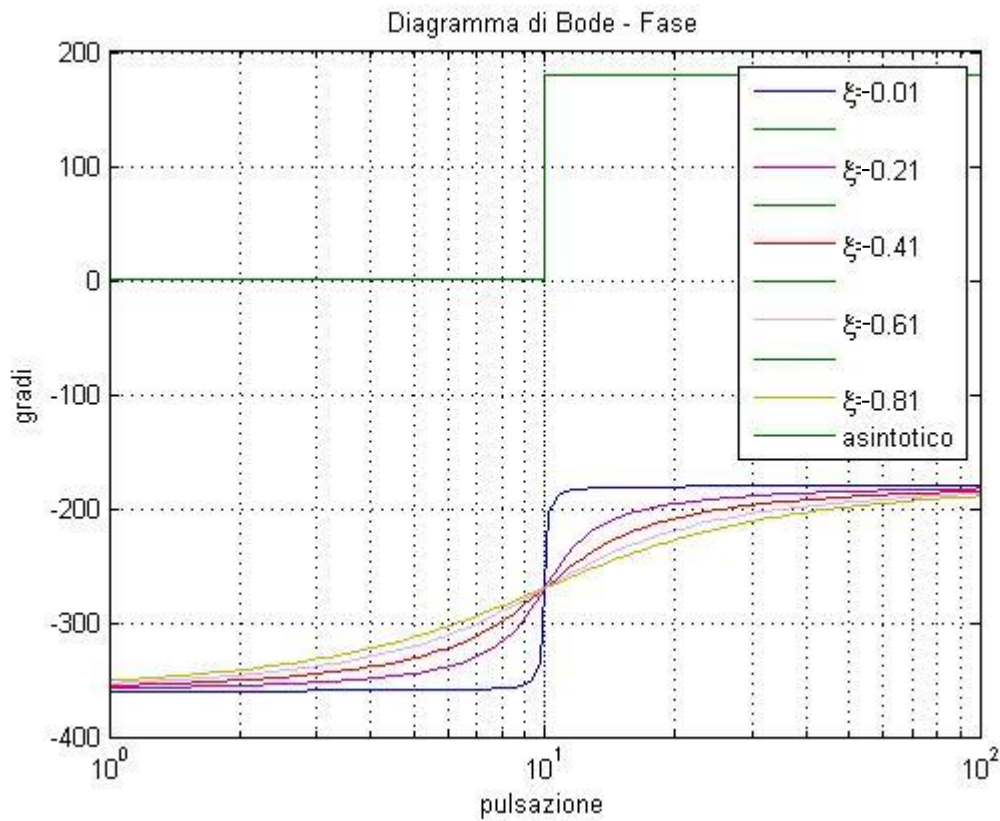


$$G(s) = \frac{1}{1 + \frac{2\xi s}{\omega_n} + \frac{s^2}{\omega_n^2}}$$





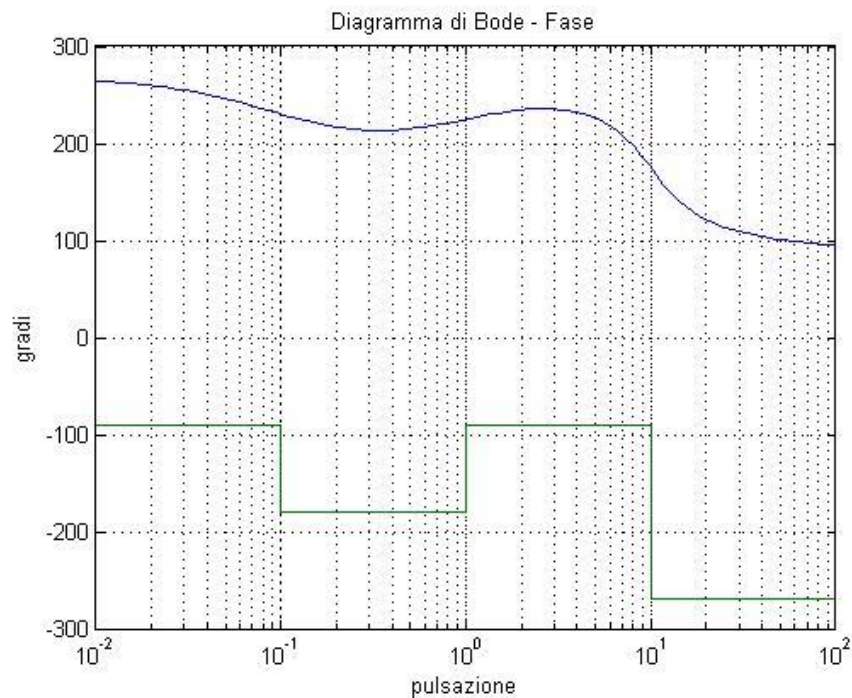
$$G(s) = \frac{1}{1 + \frac{2\xi s}{\omega_n} + \frac{s^2}{\omega_n^2}}$$





ESEMPIO

$$G(s) = \frac{-10s(1 + s)}{(1 + 10s)(1 + 0.1s + 0.01s^2)}$$





Esercizi



ESERCIZIO 1

$$G(s) = \frac{0.1s(1 + s)}{(1 + 5s)^2(1 + 0.2s)(1 - 0.1s)}$$

Diagramma di Bode - Modulo

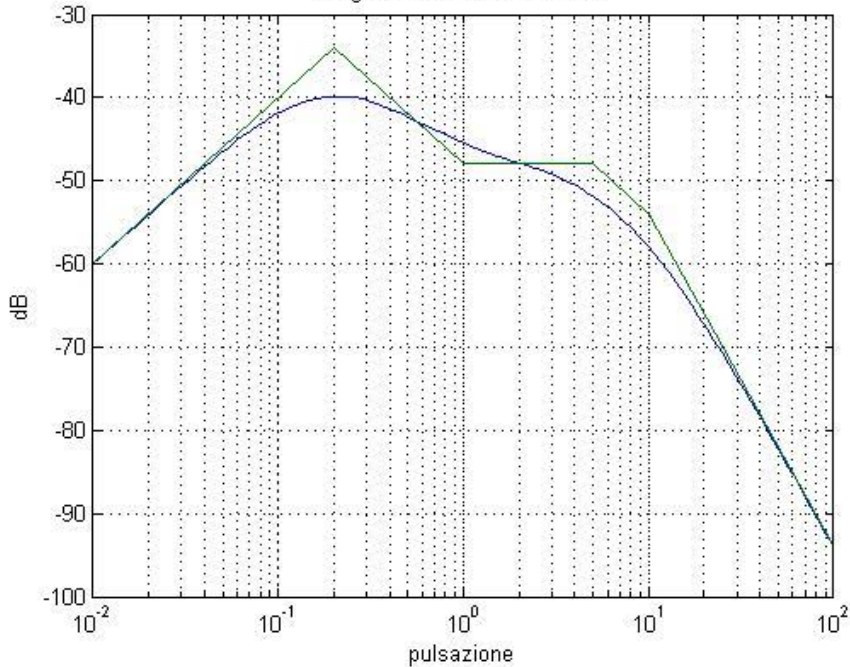
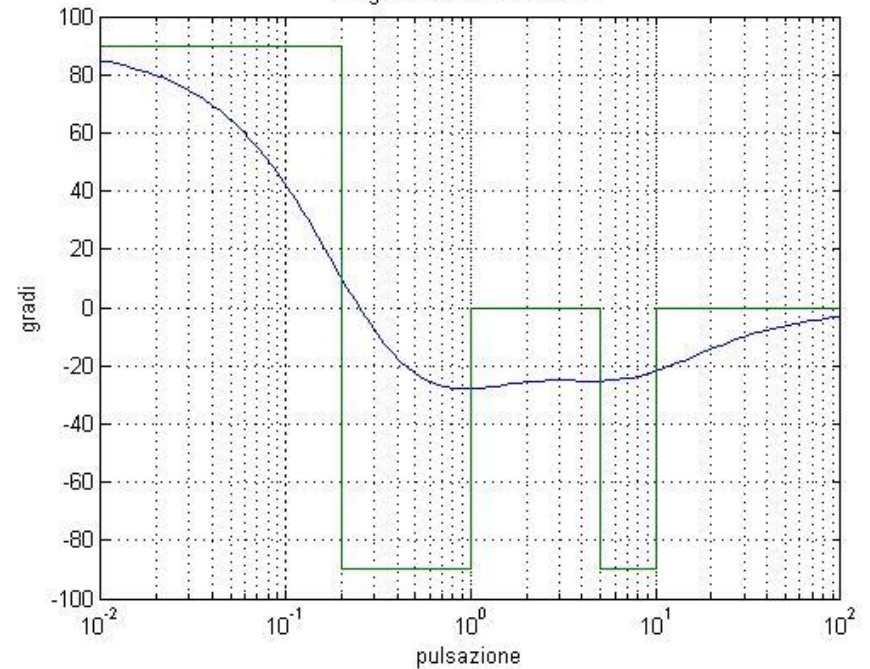


Diagramma di Bode - Fase





ESERCIZIO 2

$$G(s) = \frac{100(1 + 10s)}{s(1 + s)^2}$$

Diagramma di Bode - Modulo

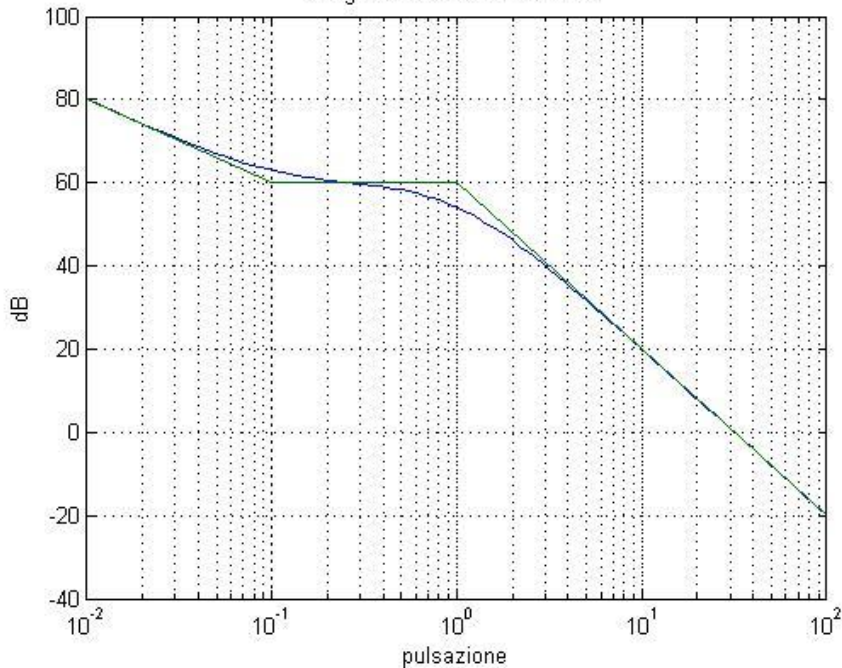
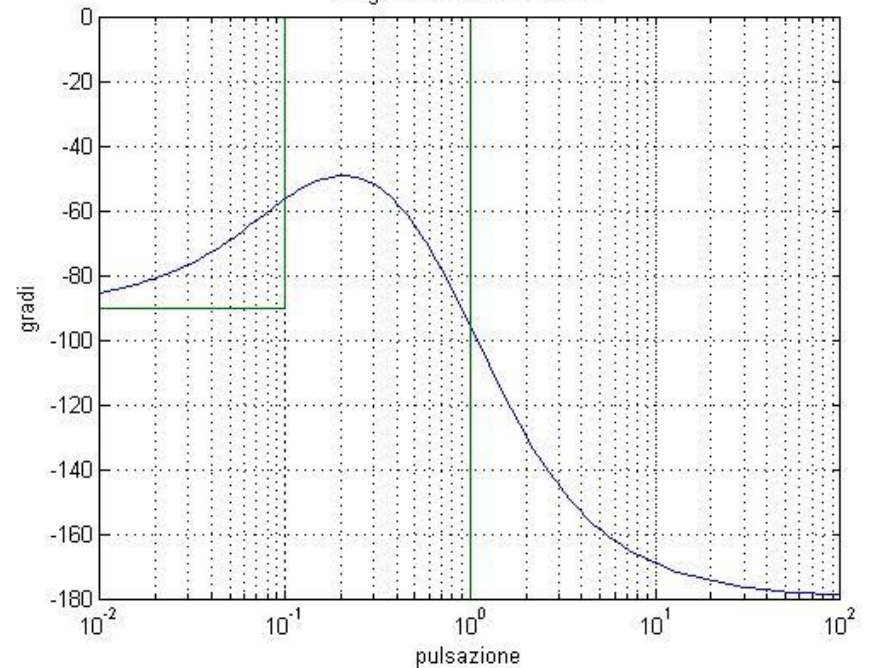


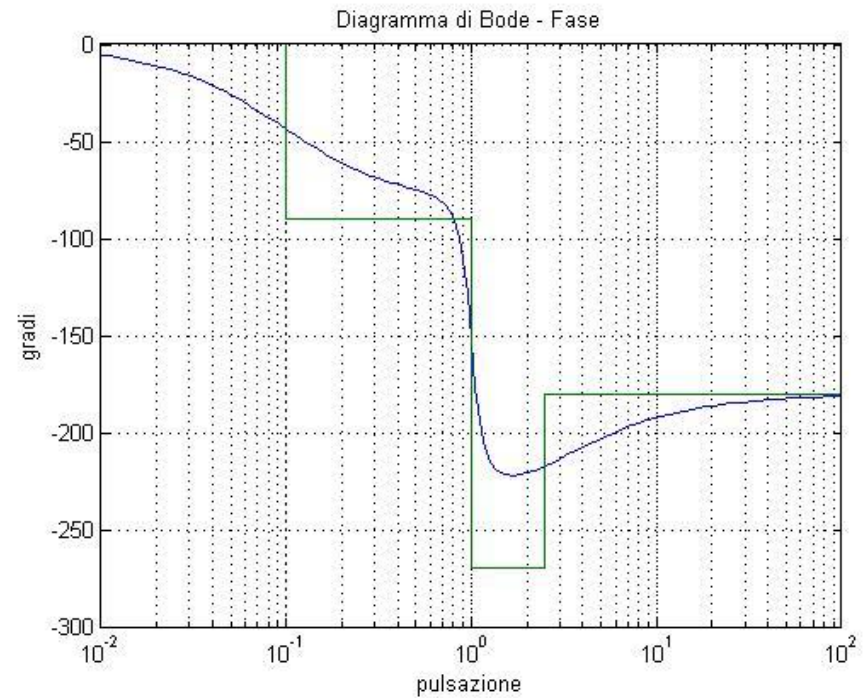
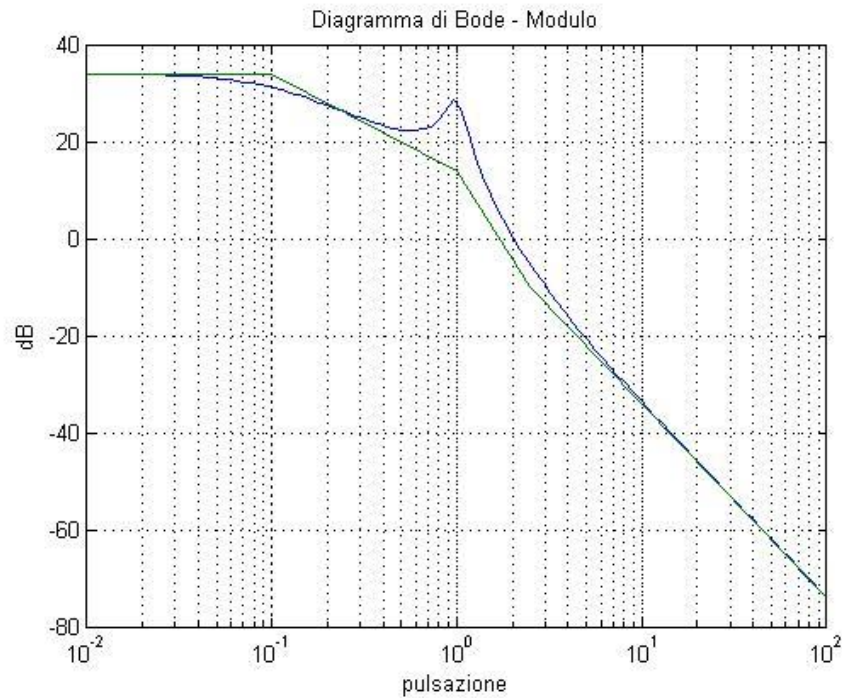
Diagramma di Bode - Fase





ESERCIZIO 3

$$G(s) = \frac{50(1 + 0.4s)}{(1 + 10s)(1 + 0.2s + s^2)}$$





ESERCIZIO 4

$$G(s) = \frac{50(1 + 0.4s)}{(1 + 10s)(1 + 0.6s + s^2)}$$

