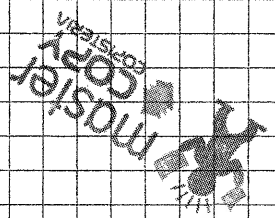
TIPOLOGIA N° 1 : Data la funzione di trasferimento disegnare i diagrammi di Bode della risposta armonica del sistema

ESERCIZIO N° 1

1

$$G(s) = 20\,\frac{(s+2)}{s^2+368s}$$



1) Mi riconduco alla forma di Bode

$$G(s) = \frac{20\cdot 2\left(\frac{s}{2}+1\right)}{368\; s\left(\frac{s}{368}+1\right)} = \frac{20.2}{368}\cdot\frac{(1+s/2)}{s(1+s/368)}$$

2) Analizzo il K e lo trasformo in valori dB

$$K = \frac{20.2}{368} = \frac{40}{368} = \frac{5}{46} \simeq 0{,}11$$

Per ottenerlo in dB $\longrightarrow$ $20\log(0{,}11) = -20$ dB

3) Analizzo poli e zeri, e studio il loro comportamento

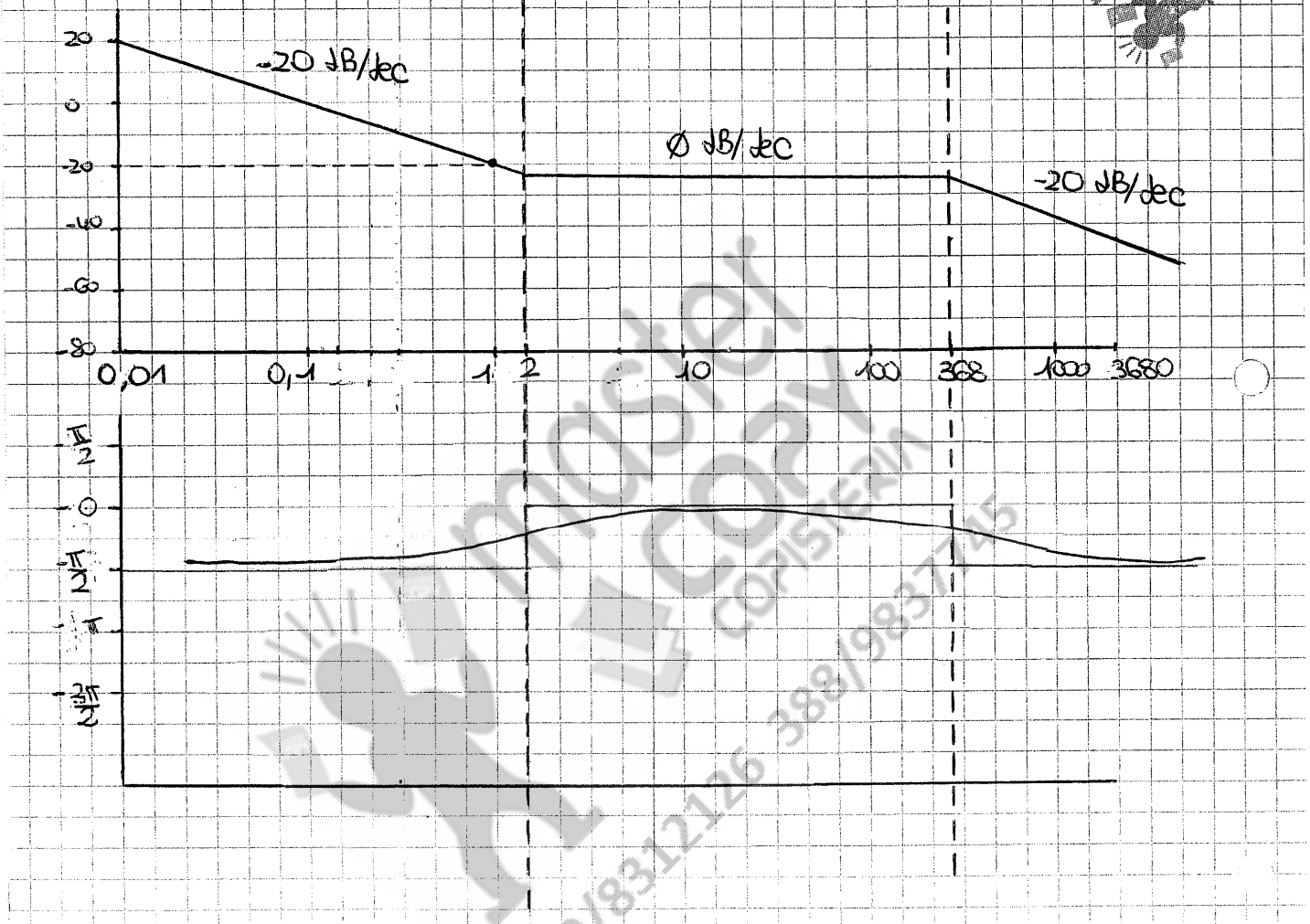
- Polo nell'origine $\longrightarrow$ -20 dB/dec
- Zero per $s=-2$ $\longrightarrow$ $+20$ dB/dec
- Polo per $s=-368$ $\longrightarrow$ -20 dB/dec

L'analisi che abbiamo appena fatto è relativa al modulo, mentre quella che farò adesso è relativa alla fase.

- Polo nell'origine $\longrightarrow$ $-\pi/2$
- Zero per $s=-2$ $\longrightarrow$ $+\pi/2$
- Polo per $s=-368$ $\longrightarrow$ $-\pi/2$

Infatti per disegnare i grafici dobbiamo analizzare poli/zeri in ordine crescente (in valore assoluto)

4) Disegnare i diagrammi di Bode



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ESERCIZIO n° 2

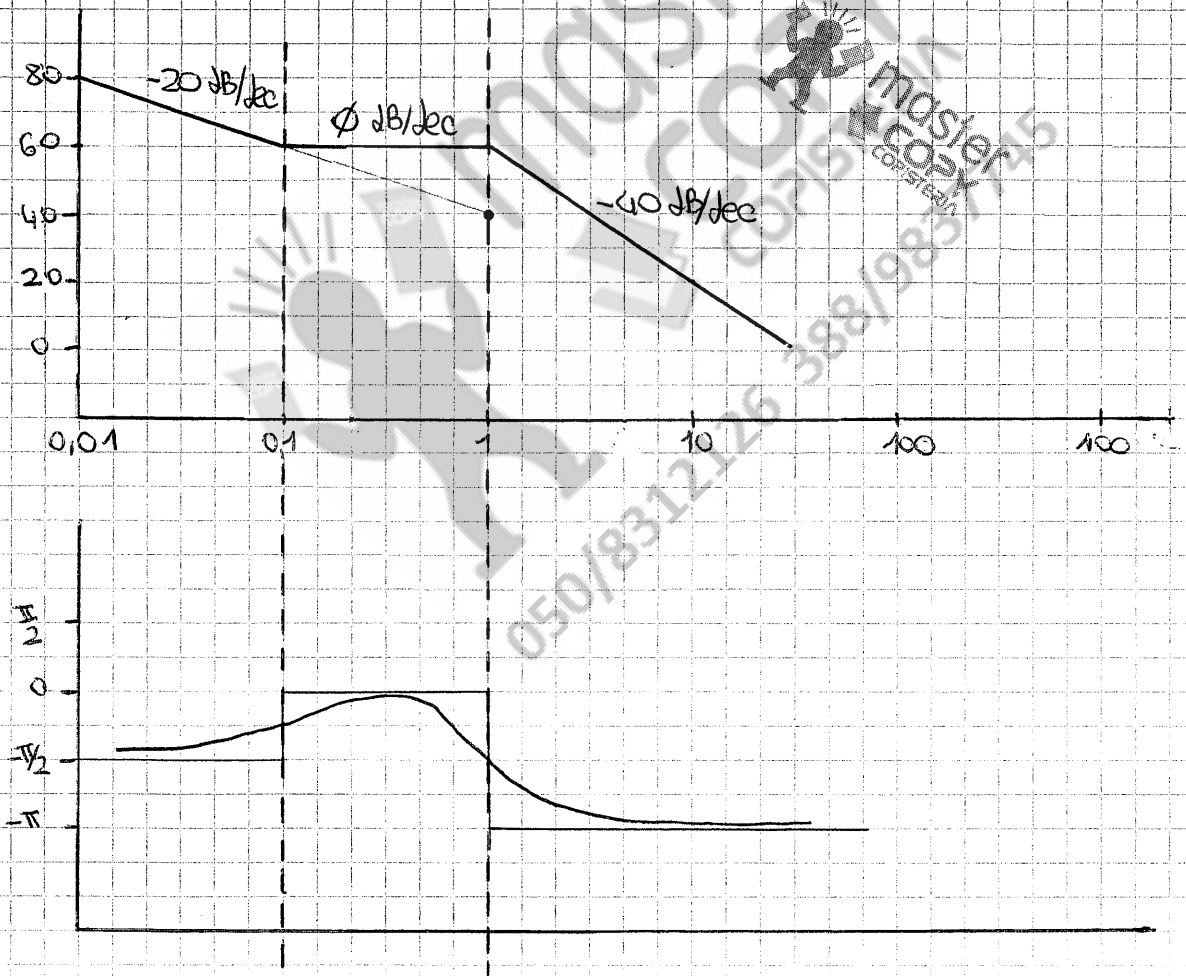
2

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

1) È già in forma di Bode

2) $k = 100 \longrightarrow 20\log(100) = 40$ dB

3)
- Polo nell'origine $\longrightarrow$ -20 dB/dec $\longrightarrow$ $-\pi/2$
- zero in $S = -0{,}1 \longrightarrow 20$ dB/dec $\longrightarrow$ $\pi/2$
- Polo in $S = -1$ con molteplicità 2 $\longrightarrow$ -40 dB/dec $\longrightarrow$ $-\pi$



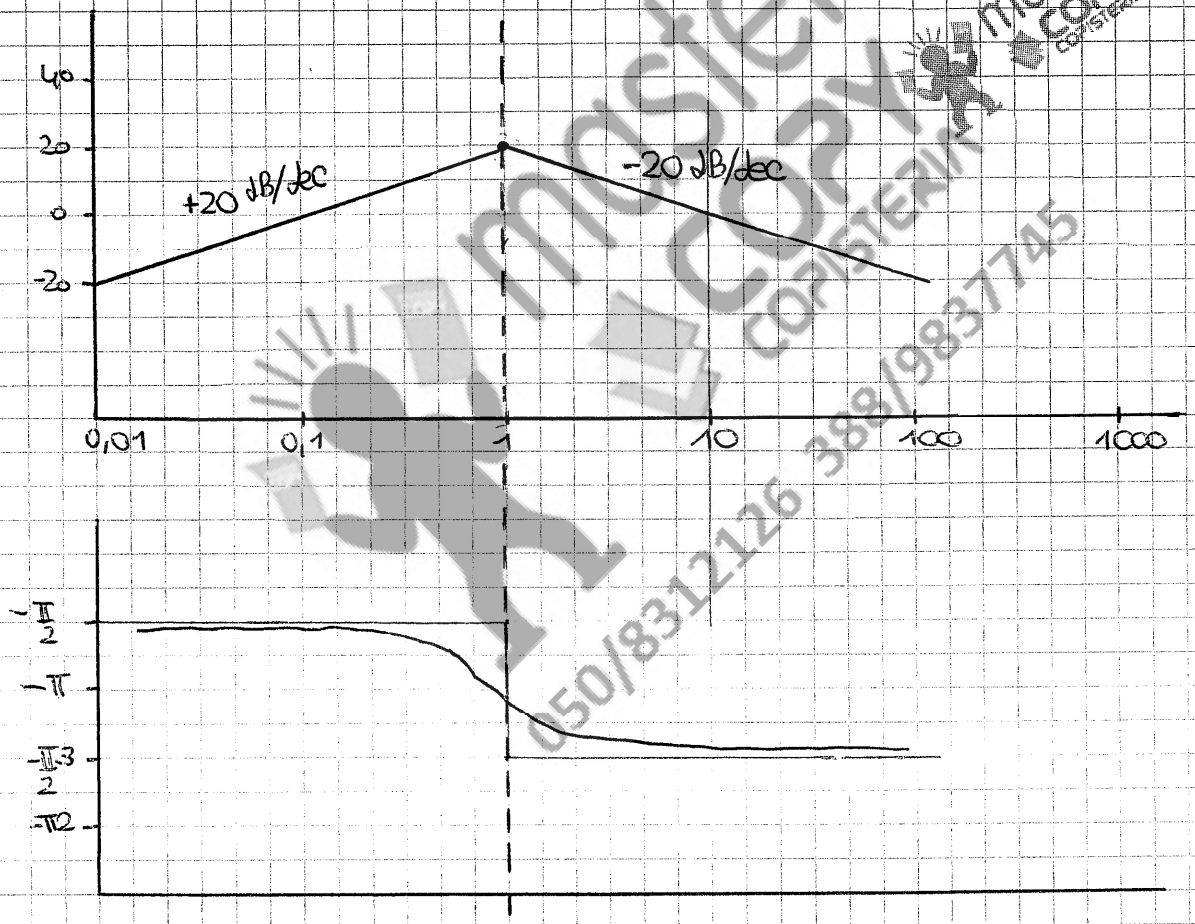
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ESERCIZIO n°3

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

2) $K = -10$ quindi $20\log|10| = 20$ dB

3)
- ZERO nell'origine $\longrightarrow$ 20 dB/dec $\longrightarrow$ $\pi/2$
- POLO in $s = -1$ con molt = 2 $\longrightarrow$ -40 dB/dec $\longrightarrow$ $-\pi$



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ESERCIZIO N° 4

$$G(S) = \frac{10\,(1+S)}{S\left(1+0{,}1S+\frac{S^2}{100}\right)}$$

2) $K = 10 \longrightarrow 20\log(10) = 20\ dB/dec$

3) ▸ zero in $S = -1 \longrightarrow 20\ dB/dec \longrightarrow \pi/2$

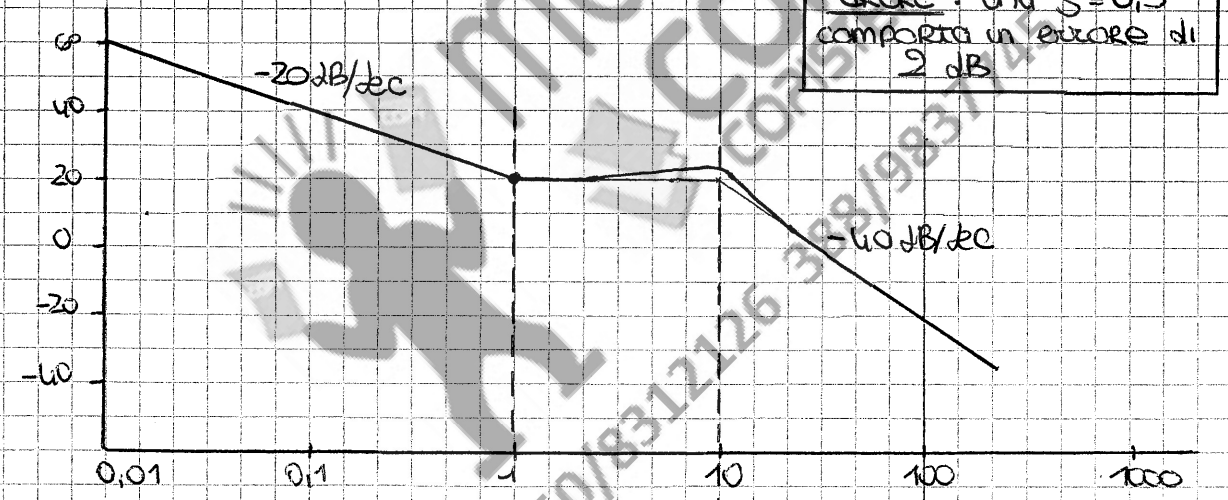
▸ polo nell'origine $\longrightarrow -20\ dB/dec \longrightarrow -\pi/2$

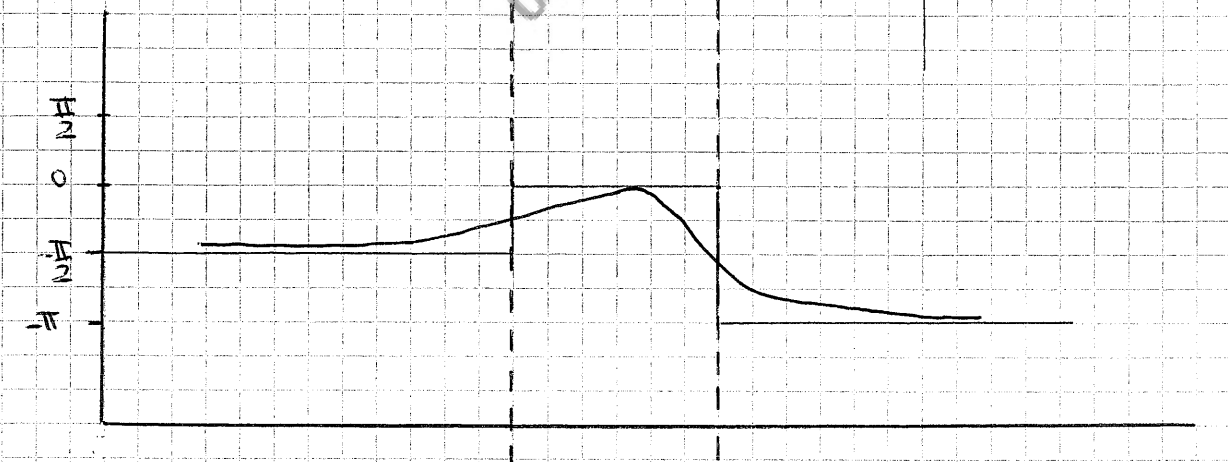
▸ poli complessi coniugati con $\longrightarrow -40\ dB/dec \longrightarrow -\pi$
$\omega_n = 10$ e $\xi = 0{,}5$

$$\longrightarrow \frac{2\xi}{\omega_n} = 0{,}1 = \frac{2\xi}{10} = 0{,}1 \Rightarrow \xi = \frac{1}{2}$$

$$\longrightarrow \frac{S^2}{\omega_n^2} = \frac{S^2}{100} \longrightarrow \omega_n = 10$$

ERORE: una $\xi = 0{,}5$ comporta un errore di 2 dB





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