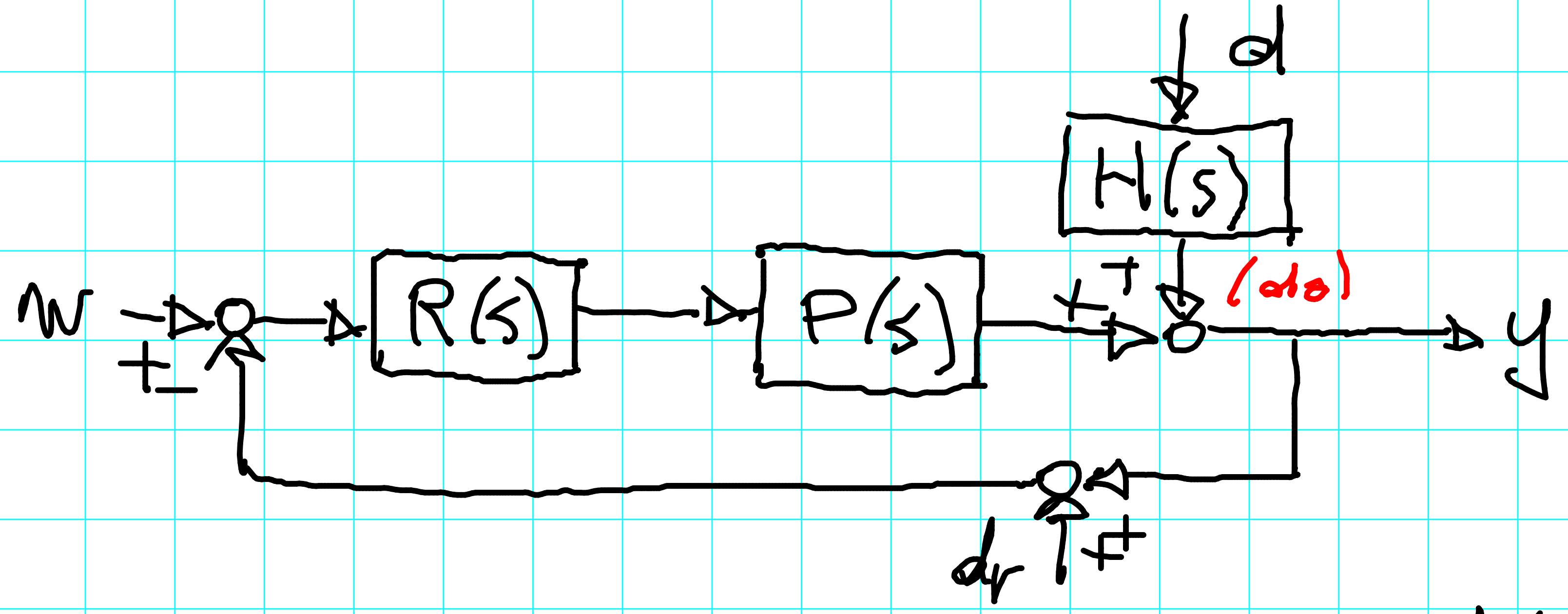
21/05/2020

E6] Dato lo schema di controllo



$$P(s) = \frac{1}{(1+3s)^2(1+0{,}1s)}$$

$$H(s) = \frac{4(1+2s)}{1+35s}$$

$w(t) = A\,\mathrm{ram}(t) \quad |A| \leq 2 \quad ; \quad d(t) = B\,\mathrm{ram}(t) \quad |B| \leq 1$

$d_r(t) = D \sin(\omega_r t + \delta) \quad |D| \leq 3, \quad \omega_r \geq 1.5$

- $|e_\infty|$ in presenza (contemporanea) di w e d sia $\leq 0{,}5$
- $|e(t)|$ dovuto a d_r sia $\leq 1 \ \forall\, \omega_r$ nel range dato
- $\omega_c \geq 0{,}2$, $\varphi_m \geq 65°$

- Progetto statico

$$H(0) = 4 \Rightarrow \text{per } t \to \infty \quad d_2(t) \sim 4\, d(t) = 4B\,\mathrm{ram}(t)$$

$$e_{\infty,d} = \lim_{s \to 0} \cancel{s}\, \frac{4B}{s^{\cancel{2}}} \underbrace{\frac{-1}{1 + \mu_L / s^{g_L}}}_{\text{FdT da } D_2 \text{ a } E}$$

$\uparrow D_2(s)$

$$= 4B \lim_{s \to 0} \frac{-s^{g_L - 1}}{\mu_L + s^{g_L}}$$

Se metto $g_L \geq 2$ $\quad e_{\infty,d} = 0$ $\quad$ però ho 2 integratori ($\angle L = -180°$)

se metto $g_L = 1$ ho solo 1 integr. in anello ma $e_{\infty,d} = -4B \frac{1}{\mu_L}$

$$e_{\infty,w} = \lim_{s\to 0} s \frac{A}{s^2} \frac{1}{1+\mu_L/s g_L}$$

stesse considerazioni su μ_L / g_L

<u>Scelgo</u> di porre sia $e_{\infty,w}$ sia $e_{\infty,d}$ entrambe in modulo $\leq 0,25$

μ_L deve essere >0 per cr. Bode

$g_L = 1$

$$\left|\frac{A}{\mu_L}\right| \leq 0,25 \text{ con } |A| \leq 2 \Rightarrow |\mu_L| \geq 8$$

$$\left|\frac{4B}{\mu_L}\right| \leq 0,25 \text{ con } |B| \leq 1 \Rightarrow \mu_L \geq 16$$

Scelgo $\mu_L = 20$

Alternativa:

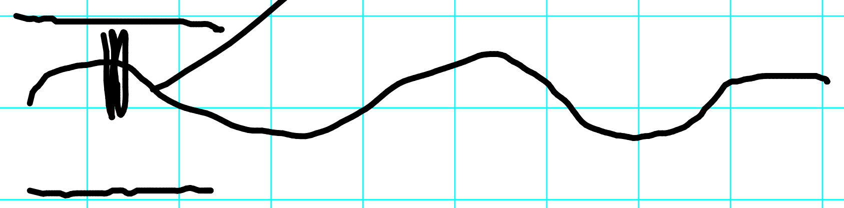
$$\frac{|A|+|4B|}{M_L} \leq 0{,}5 \Rightarrow \frac{6}{M_L} \leq 0{,}5 \Rightarrow M_L \geq 12$$

Conclusione: $g_L = 1, \quad M_L \geq 20$

Progetto dinamico:

1 $|e(t)| \leq 1 \quad \forall\, \omega_r \geq 1{,}5$,

$\Rightarrow$ asintoticamente $e(t)$



$\Rightarrow$ 1 ampl. asintotica effetto d_r su $y \leq 1$,

$\Rightarrow$ Foglio semilog (1)

Ottengo $\omega_c \simeq 0,3$ e $\varphi_m \simeq 78°$ con

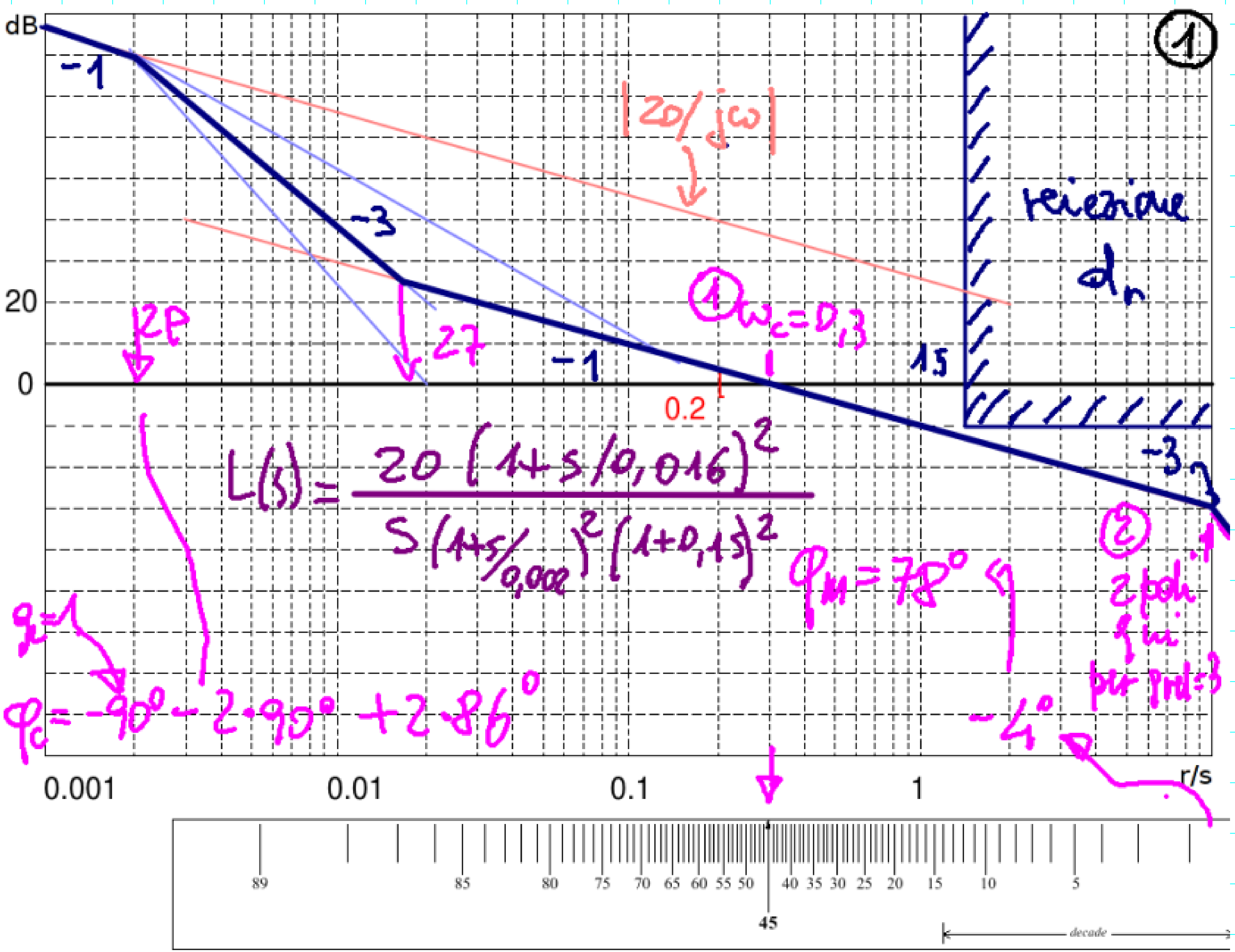
$$R(s) = \frac{L(s)}{P(s)} \simeq \frac{20\left(1+s/0,016\right)^2}{s\left(1+s/0,002\right)^2\left(1+0,1s\right)^{\cancel{2}}} \cdot \frac{(1+3s)^2\,\cancel{(1+0,1s)}}{1}$$

$$= \frac{20\left(1+s/0,016\right)^2\left(1+3s\right)^2}{s\left(1+s/0,002\right)^2\left(1+0,1s\right)}$$

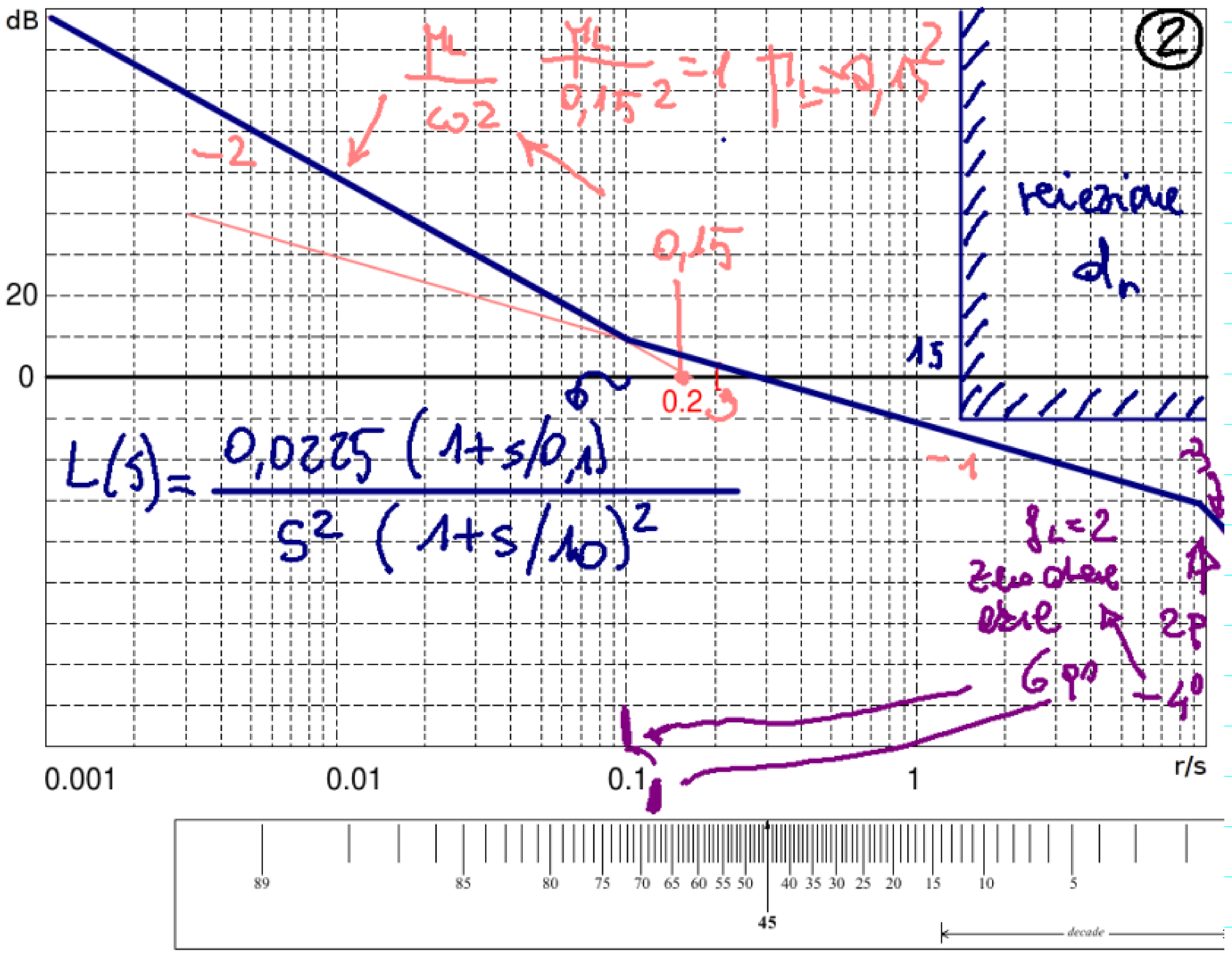
$\square$

Alternativa con $g_L = 2$ cosicché $e_\infty = 0$ $\forall \mu_L > 0$ $\Rightarrow$ Foglio semi log (2)

$\square$



dB
20
0
0.001
0.01
0.1
1
r/s
-1
-3
-1
-3
|20/jω|
reiezione
d_n
① $\omega_c = 0,3$
0.2
1
1.5
KP
27
$L(s) = \frac{20\,(1+s/0,016)^2}{s\,(1+s/0,002)^2\,(1+0,1s)^2}$
$\varphi_M = 78°$
$\xi = 1$
$\varphi_c = -90° - 2 \cdot 90° + 2 \cdot 86°$
$-4°$
②
2 poli
$\xi = 1$
89
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
decade



dB
20
0
0.001
0.01
0.1
1
r/s
2
$\frac{\mu_L}{\omega^2}$
$\frac{\mu_L}{0,15^2}=1 \quad \mu_L = 0,15^2$
-2
0,15
0.2
-1
15
reiezione d_n
$L(s) = \frac{0,0225\,(1+s/0,1)}{s^2\,(1+s/10)^2}$
89
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
decade