Esercitazione di sistemi

Riportare modulo, sfasamento, poli, zeri e diagrammi di Bode delle seguenti funzioni di trasferimento:

1. $G(s) = \frac{3000*(1+0.09*s)}{(1+8\ *s)^2(1+800*s)}$
2. $G(s) = \frac{400000*(1+5000*s)}{s*(1+0.5*s)}$

$$|G(s)|_{dB} = 20\log 3000 + 20\log|1 + 0.09s| - 40\log|1 + 80s| - 20\log|1 + 800s| =$$

$$= 20log3000 + 20log\sqrt{1 + (0.09s)^2} - 40log\sqrt{1 + (80s)^2} - 20log\sqrt{1 + (800s)^2}$$

$20log\sqrt{1 + (0.09s)^2}$ $\quad s = 11.1 \quad 20log\sqrt{1 + (0.09 * 11.1)^2} = 20log\sqrt{1 + 1} = 20log\sqrt{2} = 20log1.4 = 3\ dB$

$20log\sqrt{1 + (0.09s)^2}$ $\quad s = 111.1 \quad 20log\sqrt{1 + (0.09 * 111.1)^2} = 20log\sqrt{1 + 100} = 20log\sqrt{101} = 20log10 = 20dB$

$40log\sqrt{1 + (80s)^2}$ $\quad s = 0.0125 \quad 40log\sqrt{1 + (80 * 0.0125)^2} = 40log\sqrt{1 + 1} = 40log\sqrt{2} = 40log1.4 = 6\ dB$

$40log\sqrt{1 + (80s)^2}$ $\quad s = 0.125 \quad 40log\sqrt{1 + (80 * 0.125)^2} = 40log\sqrt{1 + 100} = 40log\sqrt{101} = 40log10 = 40dB$

$20log\sqrt{1 + (800s)^2}$ $\quad s = 0.00125 \quad 20log\sqrt{1 + (80 * 0.00125)^2} = 20log\sqrt{1 + 1} = 20log\sqrt{2} = 20log1.4 = 3\ dB$

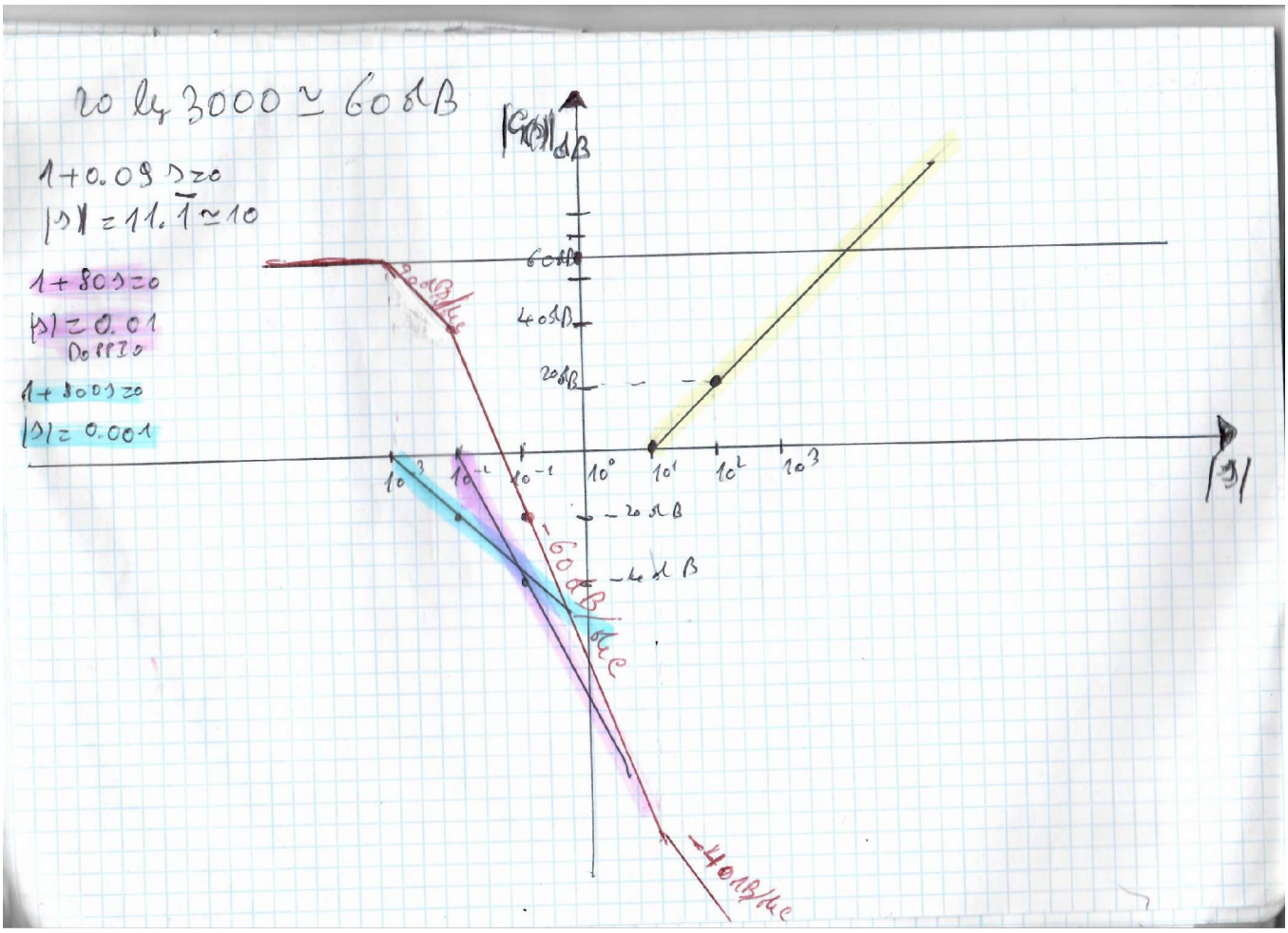
$20log\sqrt{1 + (800s)^2}$ $\quad s = 0.0125 \quad 20log\sqrt{1 + (800 * 0.0125)^2} = 20log\sqrt{1 + 100} = 20log\sqrt{101} = 20log10 = 20\ dB$

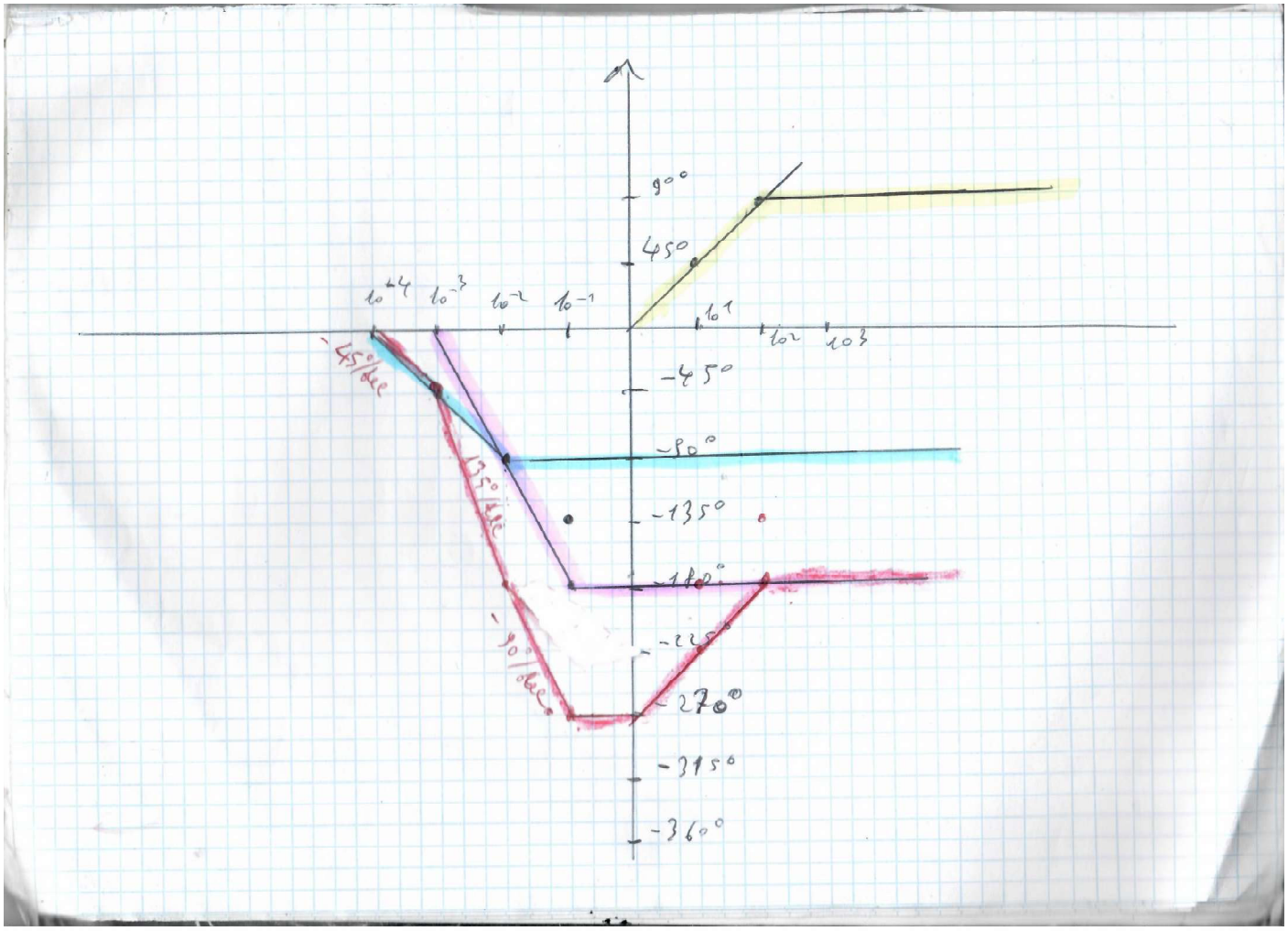
$$\varphi(s) = arctg\frac{0}{3000} + arctg\frac{0.09s}{1} - 2arctg\frac{80s}{1} - arctg\frac{800s}{1}$$

$$arctg\frac{0.09s}{1} = \begin{Bmatrix} s = 1.11 \quad arctg0.09 * 1.1 = arctg0.09 = 0.57° \\ s = 11.1 \;\; arctg0.09 * 11.1 = arctg1 = 45° \\ s = 111.1 \; arctg0.09 * 111.1 = arctg10 = 84° \end{Bmatrix}$$

$$arctg\frac{80s}{1} = \begin{Bmatrix} s = 0.00125 \quad arctg80 * 0.00125 = arctg0.09 = 0.57° \\ s = 0.0125 \;\; arctg80 * 0.0125 = arctg1 = 45° \\ s = 0.125 \;\; arctg80 * 0.125 = arctg10 = 84° \end{Bmatrix}$$

$$arctg\frac{800s}{1} = \begin{Bmatrix} s = 0.000125 \quad arctg800 * 0.000125 = arctg0.09 = 0.57° \\ s = 0.0125 \;\; arctg800 * 00.0125 = arctg1 = 45° \\ s = 0.125 \;\; arctg800 * 0.0125 = arctg10 = 84° \end{Bmatrix}$$


20 log 3000 ≃ 60 dB
1 + 0.09 > 0
|> | = 11. 1 ≃ 10
1 + 80 > 0
|> | = 0.01
Doppio
1 + 3001 > 0
|> | = 0.001
|G(jω)| dB
60 dB
40 dB
20 dB
-20 dB
-40 dB
-60 dB/dec
-40 dB/dec
10^-3
10^-2
10^-1
10^0
10^1
10^2
10^3
ω


90°
45°
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{1}
10^{2}
10^{3}
-45°
-90°
-135°
-180°
-270°
-315°
-360°
-45°/dec
-90°/dec