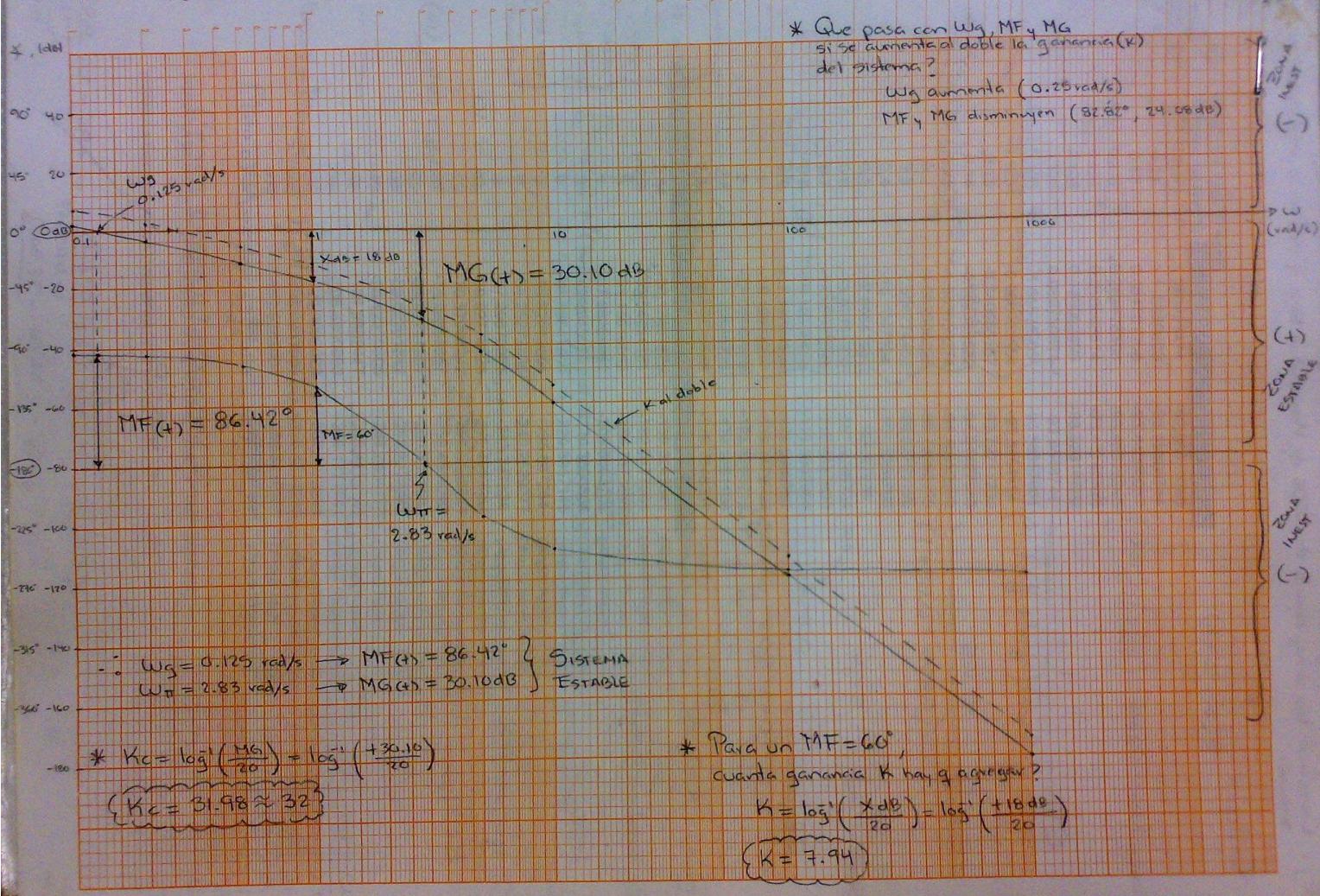


$$② - G(s) = \frac{K}{s(s^2 + 4s + 8)}$$

$$C/V_{\text{ref}} = 4 \text{ dB} = 9^\circ$$

SEMI-LOGARITMICO 5 CICLOS X 70 DIVISIONES



Ej. Constituir los diagramas de BODE de Magnitud y Fase y definir la es sistema:

$GH(s) = \frac{K}{s(s^2 + 4s + 8)}$

$$GH(s) = \frac{K}{s(s^2 + 4s + 8)}$$

$$s_{1,2} = \frac{-4 \pm \sqrt{16 - 4(1)(8)}}{2} = \frac{-4 \pm \sqrt{8}}{2}$$

Forma Normalizada: $\left(\frac{1}{\tau s + 1}\right), (\tau s + 1)$

$$s_{1,2} = \frac{-4 \pm 4j}{2} = -2 \pm 2j$$

$$GH(s) = \frac{1}{s(8)\left(\frac{1}{8}s^2 + \frac{4}{8}s + 1\right)}$$

$$GH(s) = \frac{0.125}{s(0.125s^2 + 0.5s + 1)}$$

Forma Compleja: $s = j\omega$

$$GH(j\omega) = \frac{0.125 + aj}{(0 + j\omega)(0.125j\omega^2 + 0.5j\omega + 1)}$$

CTE
POLO ORIGEN
POLOS CUADRATICOS

Método: Analítico

Ec. total en MAGITUD:

$$|GH(j\omega)|_{dB} = \underbrace{20 \log(0.125)}_{CTE} - \underbrace{20 \log \omega}_{POLO ORIGEN} - 10 \log \left[\frac{(1 - 0.125\omega^2)^2 + (0.5\omega)^2}{\omega^2} \right]$$

Ec. total en FASE:

$$\angle GH(j\omega) = \underbrace{\lg^{-1} \frac{0}{0.125}}_{0^\circ} - \underbrace{\tg^{-1} \frac{\omega}{0}}_{90^\circ} - \underbrace{\lg^{-1} \frac{0.5\omega}{1 - 0.125\omega^2}}_{\text{POLOS CUADRATICOS}}$$

ω	MAG	FASE	\times^2 MAG
0.1	1.94	-92.86	7.95
0.2	-4.08	-95.73	1.93
0.5	-12.04	-104.47	-6.03
1	-18.12	-119.74	-12.11
5	-42.36	-220.36	-36.35
10	-60.02	-246.49	-54.01
100	-120	-267.7	-113.99
1000	-180	-269.77	-173.99

Para Polos Cuadráticos

$$\text{MAG: } -20 \log_{10} \left[(1 - \tau\omega^2)^2 + (\tau\omega)^2 \right]^{1/2}$$

FASE:

$$-\lg^{-1} \frac{\tau\omega}{1 - \tau\omega^2}$$

POLOS CUADRATICOS

$$Y = X + Yj$$

$$\text{MAG} = \sqrt{X^2 + Y^2}$$

$$\text{MAG} = (X^2 + Y^2)^{1/2}$$

$$|\text{MAG}|_{dB} = 20 \log (MAG)$$

$$\text{FASE: } \lg^{-1} \frac{Y}{X}$$

$$X = 10$$

$$1 \times 10 = 20 \log_{10} (10) = \underline{x}$$

Para $\omega = 0.1 \text{ rad/s}$

$$|GH(j\omega)|_{dB} = -18.06 + 20 - 10 \log \left[(1 - 1.25 \times 10^{-3})^2 + (0.05)^2 \right]$$

$$= 1.94 - 10 \log \left[(0.99875)^2 + (0.05)^2 \right]$$

$$= 1.94 - 10 \log [0.9975 + 2.5 \times 10^{-3}]$$

$$= 1.94 - 0$$

$$= 1.94 \text{ dB}$$

$$\angle GH(j\omega) = 0^\circ - 90^\circ - \lg^{-1} \frac{0.5(0.1)}{1 - 0.125(0.1)^2} = -90^\circ - \lg^{-1} \frac{0.05}{1 - 1.25 \times 10^{-3}}$$

$$= -90^\circ - 2.86^\circ = \underline{-92.86^\circ}$$

$$GH(s) = K / s(s^2 + 4s + 8)$$

Frecuencia (rad/s)	Magnitud, dB	Fase, Grados
0.1	1.938193474	-92.86619285
0.11	1.110336622	-93.15308744
0.12	0.354561268	-93.44006057
0.121	0.282478308	-93.46876248
0.122	0.210988614	-93.49746525
0.123	0.140082499	-93.52616889
0.124	0.069750514	-93.5548734
0.125	-1.6567E-05	-93.58357881
ω_g	0.1251	-0.006962554
	0.13	-93.5864494
	-0.340686167	-93.72711934
	0.14	-0.984386522
	-94.01427083	0.15
	-1.583659274	-94.30152209
	0.2	-4.082508225
	-95.73952125	0.3
	-7.604774453	-98.62701196
	0.4	-10.1047364
	-101.5354703	0.5
	-12.04543891	-104.47136
	0.6	-13.63361032
	-107.4406724	0.7
	-14.98002288	-110.4487833
	0.8	-16.15130576
	-113.5002966	0.9
	-17.19094524	-116.5988767
	1	-18.12913357
	-119.7470723	2
	-25.05149978	-153.4396215
	2.8	-29.92840731
	-179.1881138	2.82
	-30.05124149	-179.7648331
ω_n	2.83	-30.11265993
	-30.0384208	(Angulo Negativo + 180)
	-30.17407825	-180.3242541
	(Angulo Negativo + 180)	2.9
	-30.54254181	-182.0177864
	(Angulo Negativo + 180)	3
	-31.15610512	-184.7573631
	(Angulo Negativo + 180)	4
	-37.09269961	-206.5603785
	(Angulo Negativo + 180)	5
	-42.36159231	-220.3608804
	(Angulo Negativo + 180)	6
	-46.89841409	-229.3957146
	(Angulo Negativo + 180)	7
	-50.82013004	-235.667254
	(Angulo Negativo + 180)	8
	-54.25273305	-240.2529277
	(Angulo Negativo + 180)	9
	-57.29670901	-243.747824
	(Angulo Negativo + 180)	10
	-60.02770628	-246.4997034
	(Angulo Negativo + 180)	15
	-70.57096242	-254.5428624
	(Angulo Negativo + 180)	20
	-78.06353657	-258.4645297
	(Angulo Negativo + 180)	25
	-83.87711201	-260.7931863
	(Angulo Negativo + 180)	30
	-88.62761842	-262.3374845
	(Angulo Negativo + 180)	40
	-96.12370805	-264.2604788
	(Angulo Negativo + 180)	50
	-101.9382447	-265.4111198
	(Angulo Negativo + 180)	60
	-106.6890965	-266.1771741
	(Angulo Negativo + 180)	100
	-120.0000028	-267.7073891
	(Angulo Negativo + 180)	200
	-138.0617999	-268.8539236
	(Angulo Negativo + 180)	500
	-161.9382003	-269.5415951
	(Angulo Negativo + 180)	1000
	-180	-269.7707994
		(Angulo Negativo + 180)

$$\omega = 3 \text{ rad/s}$$

$$G H(j\omega) = 0^\circ - 90^\circ - \operatorname{tg}^{-1} \underbrace{\frac{0.5(3)}{1 - 0.125(3)^2}}$$

$$\operatorname{tg}^{-1} \frac{1.5}{1 - 1.125} = \operatorname{tg}^{-1} \frac{1.5}{-0.125} = \operatorname{tg}^{-1} -12 = \underline{-85.23^\circ}$$

FORMA CORRECTA:

$$= -90^\circ - (-85.23^\circ + 180^\circ)$$

$$= -90^\circ - (94.77^\circ)$$

$$= \underline{-184.77^\circ}$$

NOTA: Ángulo Negativo,
hay que sumar
 $+180^\circ$

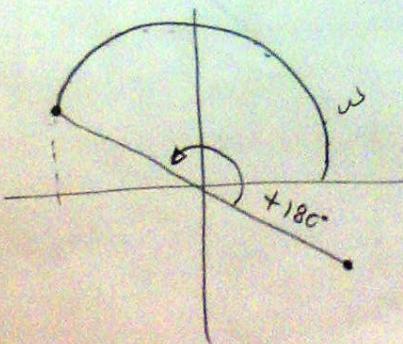
- * Si no sumamos $+180^\circ$ a este ángulo negativo el ángulo final total sería
- $$= -90^\circ - (-85.23^\circ)$$
- $$= \underline{-4.77^\circ}$$

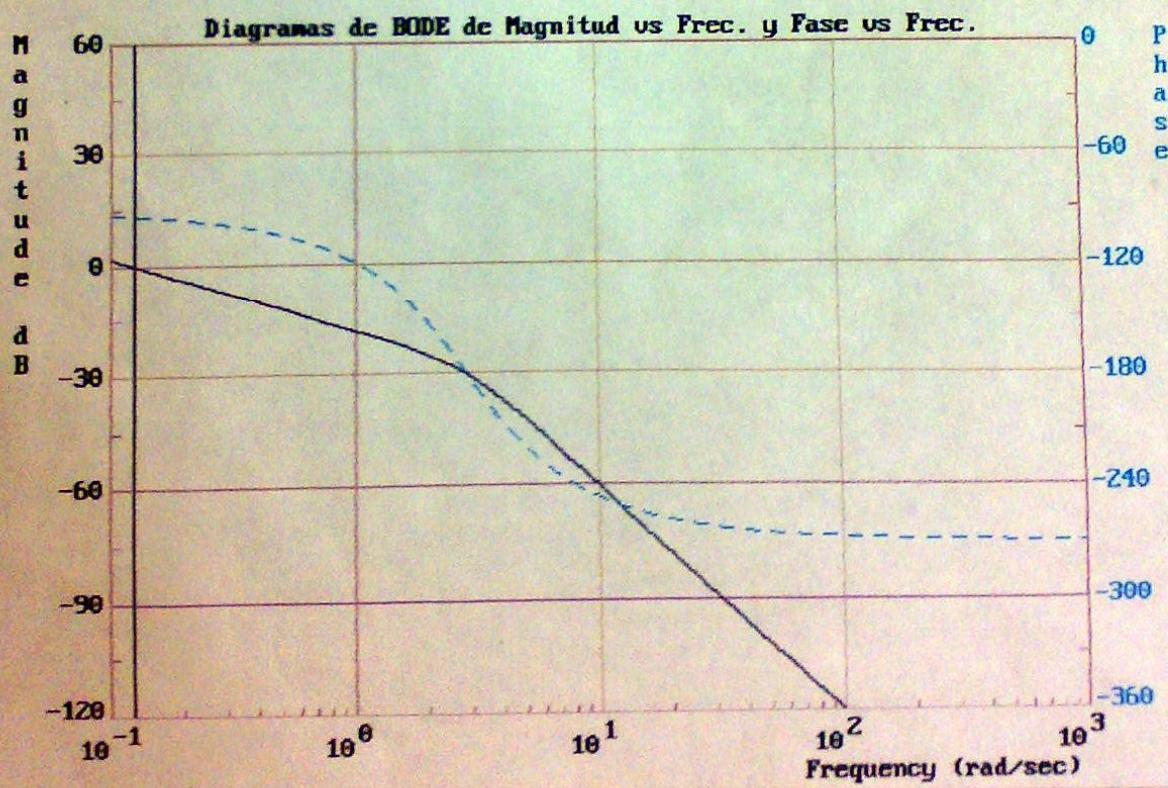
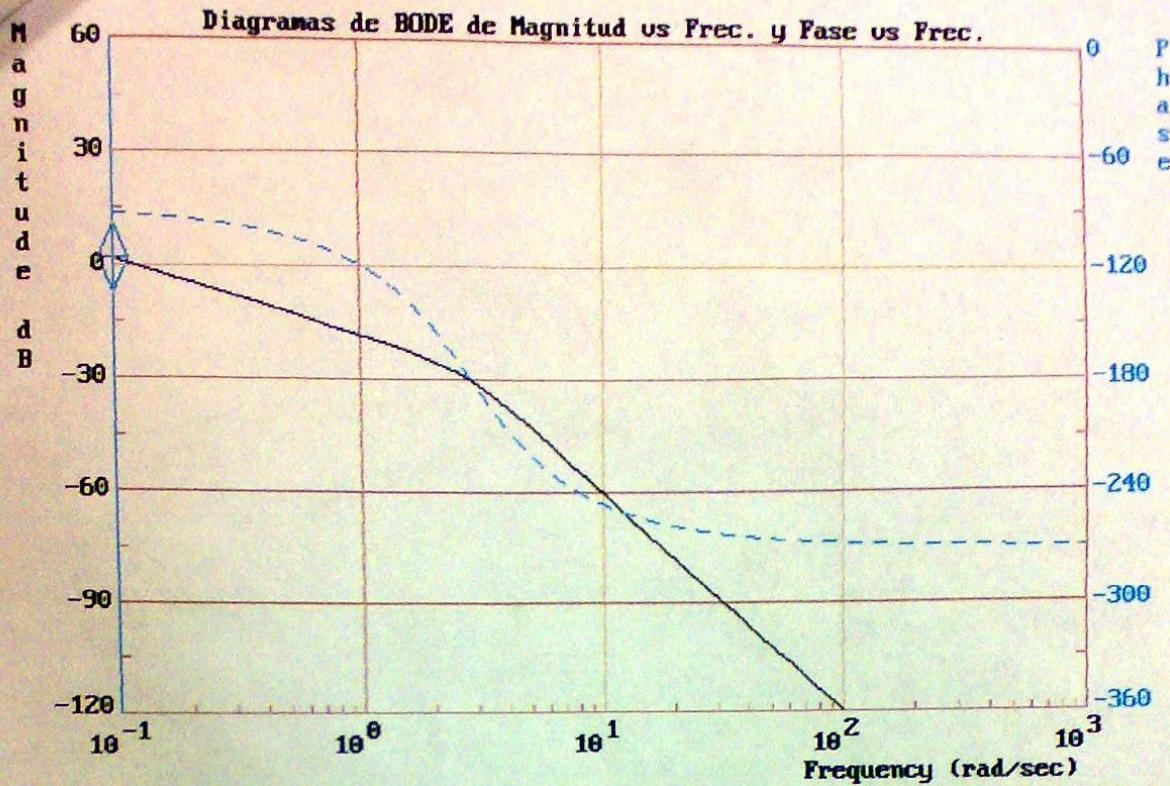
FORMA INCORRECTA:

$$= -90^\circ - (-85.23^\circ)$$

$$= -90^\circ + 85.23^\circ$$

$$= \underline{-4.77^\circ}$$





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