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B-6.3

$$G(s) = \frac{K}{s(s+0,5)(s^2+0,6s+10)} \qquad H(s) = 1$$

$$TF_{CL} = \frac{K/[s(s+0,5)(s^2+0,6s+10)]}{1+K/[s(s+0,5)(s^2+0,6s+10)]} = \frac{K}{s(s+0,5)(s^2+0,6s+10)+K}$$

$$TF_{CL} = \frac{K}{(s^2+0,5s)(s^2+0,6s+10)+K} = \frac{K}{s^4+1,1s^3+10,3s^2+5s+K}$$

Open Loop Poles and Zeroes

$P_0 = 0$ $\quad P_{2,3} = -0,3 \pm j\,3,148$

$P_1 = -0,5$ $\quad$ No Zeroes

x & y crossings

x-crossing

$$1 + \frac{K}{s(s+0,5)(s^2+0,6s+10)} = 0$$

$$K = -(s^4+1,1s^3+10,3s^2+5s)$$

$$\frac{\partial K}{\partial \sigma}\Big|_{j\omega=0} = -14\sigma^3 + 3,3\sigma^2 + 20,6\sigma + 5 = 0$$

$\sigma_1 = -0,25$ $\quad \sigma_{2,3} = -0,2876 \pm j\,2,2183$

↳ NÃO CONVÉM

$K > 0$

$28,772 - 1,1K > 0$

$1,1K < 28,772$

$K < 26,157 0$

$s = 0 \pm j\,52,132$

Substituting into Characteristic Quation

Assymptotes

X-Axis crossings

$$\sigma_a = \frac{\Sigma \text{poles} - \Sigma \text{zeroes}}{\#\text{poles} - \#\text{zeroes}}$$

$$\sigma_a = \frac{0 - 0,5 - 0,3 - 0,3}{4} = -\frac{0,11}{4}$$

Angles

$$\theta_{ak} = \frac{(2k+1)\pi}{4}$$

$\theta_{a0} = \pi/4$ $\quad \theta_{a1} = 3\pi/4$

$\theta_{a2} = 5\pi/4$ $\quad \theta_{a3} = 7\pi/4$

Y-crossing

s^4	1	$10,3$ $\quad K$
s^3	1,1	5
s^2	5,754	K
s^1	$\frac{28,772 - 1,1K}{5,754}$	0
s^0	K	

Departure and Arrival angles

No finite zeroes ⇒ No ARRival angles

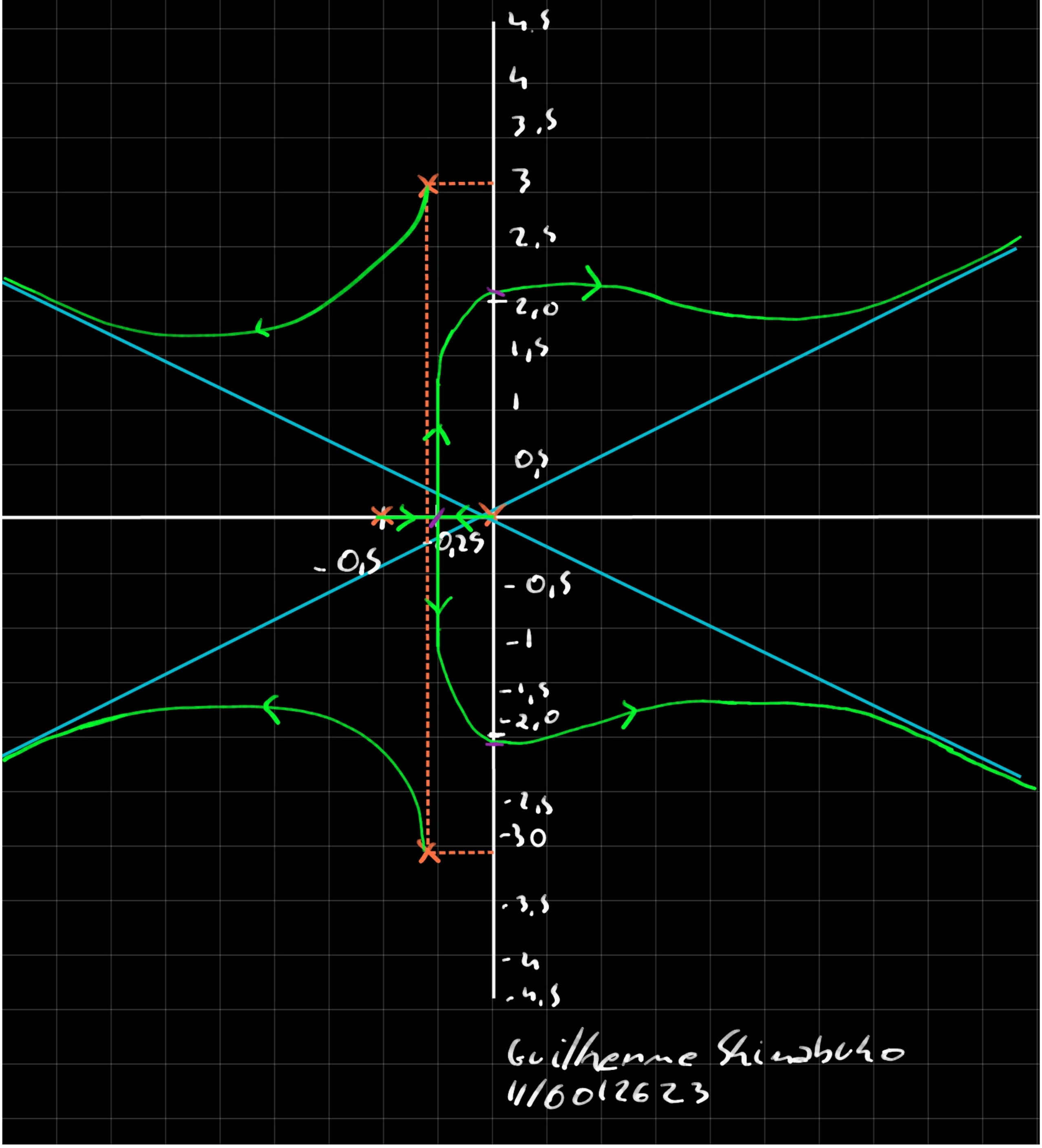
Departure angles

$$\theta_3 = -\angle(P_x - P_1) - \angle(P_x - P_2) - \angle(P_x - P_4) - (2k+1)\pi$$

$$\theta_3 = -\angle(-0{,}3 + j3{,}148 - 0) - \angle(0{,}3 + j3{,}148 + 0{,}5) - \angle(2\,j3{,}148) - (2k+1)\pi$$

$$\theta_3 = -\angle(-0{,}3 + j3{,}148) - \angle(,8 + j3{,}148) - \pi/2 - (2k+1)\pi$$

$$\theta_3 = -271{,}8085^\circ = 268{,}1914^\circ$$



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B-6-15

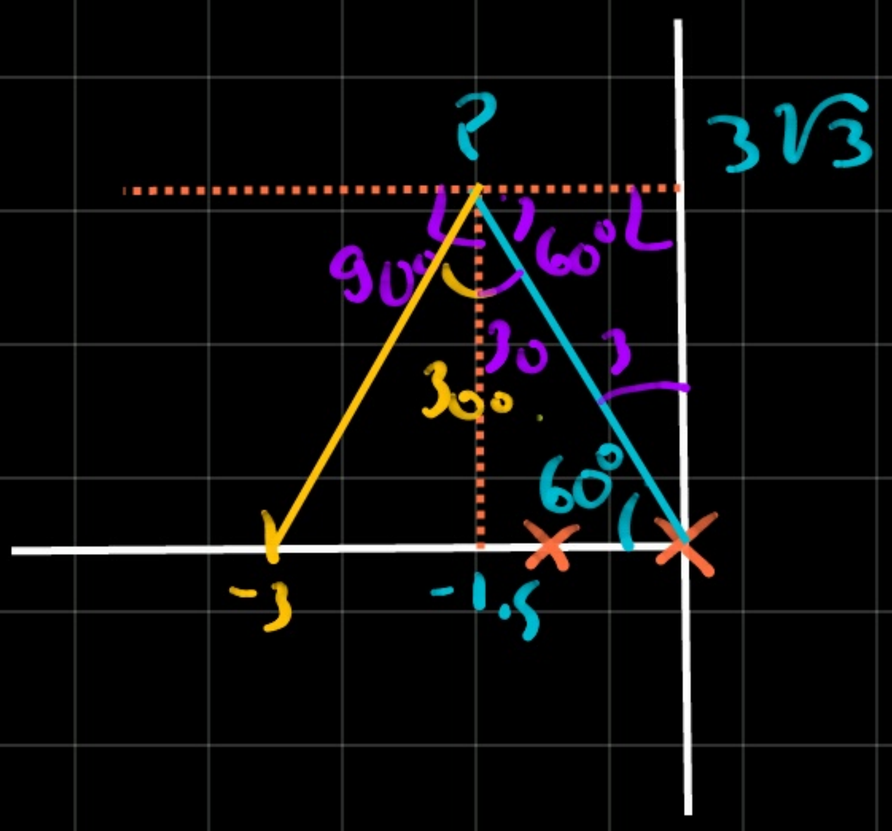
$s = -1,5 + j\,3\sqrt{3}/2$

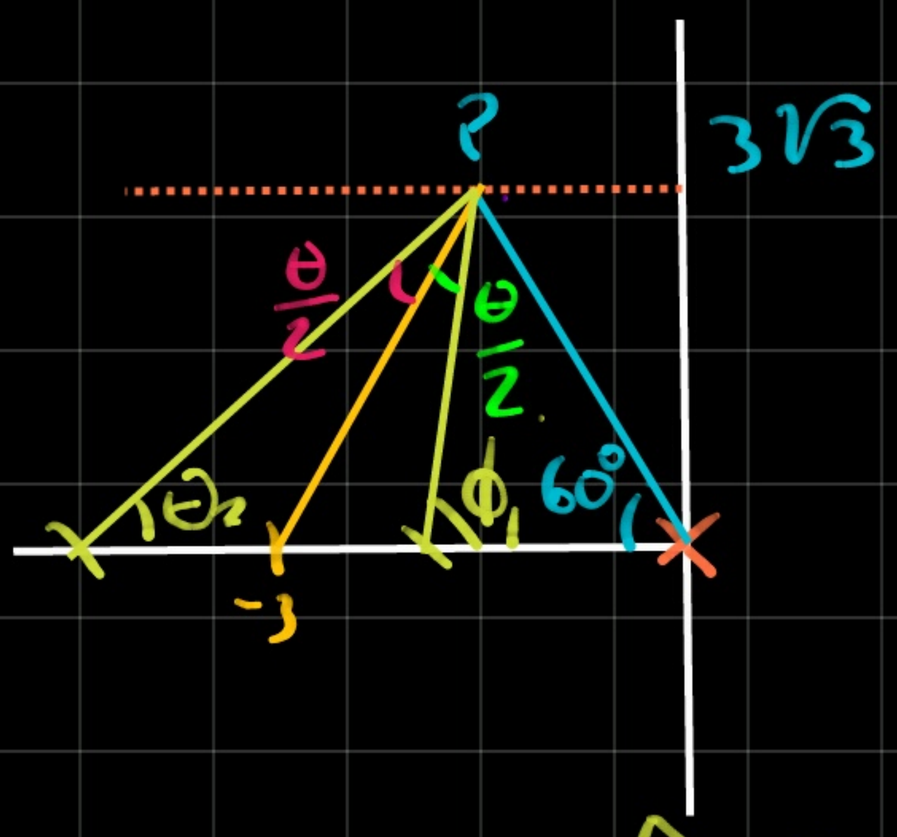
Para Que s seja parte DO LGR, a Deficiência Angular pode ser calculada

Como:

$$\theta = (2k+1)180 - \angle(s - p_0) - \angle(s - p_1)$$
$$\theta = (2k+1)180 - \angle(s - 0) - \angle[s - (-1)]$$
$$\theta = (2k+1)180 - 120^\circ - 100,894^\circ = -40,894^\circ$$

Essa Deficiência será preenchida pelo Compensador DeAvanço de fase



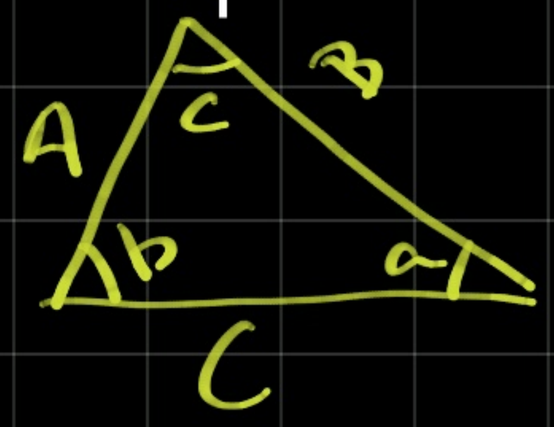


$$\phi_1 = 180 - 60 - (60 - \frac{\theta}{2})$$
$$\phi_1 = 60 + \theta/2 = 60 + \frac{40,894}{2} = 80,447^\circ$$
$$\phi_2 = 180 - 60 - (60 + \theta/2)$$
$$\phi_2 = 60 - \frac{40,894}{2} = 39,553$$

$$\frac{3}{\text{sen}(80,447^\circ)} = \frac{\sigma}{\text{sen}(39,553^\circ)}$$

$$T_1 = 1,9432$$
$$T_2 = 4,6458$$

$$\left| k \frac{s+T_1}{s+T_2} \frac{10}{s(s+1)} \right| = 1$$
$$s = -1,5+32,5981$$



$$\frac{A}{\text{sen}\,a} = \frac{B}{\text{sen}\,b} = \frac{C}{\text{sen}\,c}$$

$$k = 1,2787$$