SOLUCIÓN PROBLEMA 2

a.
$$\left.\begin{array}{l} v_o = A\cdot[v_+ - v_-] \\ v_+ = \alpha v_o \\ v_- = v_c \\ i_c = C\dot{v}_c = \dfrac{v_o - v_c}{R_3} \end{array}\right\} \Rightarrow v_o = A[\alpha v_o - v_c]$$

$$\Rightarrow v_o = -\frac{A v_c}{1-\alpha A} = \frac{A}{\alpha A - 1} v_c$$

$$\Rightarrow R_3 C \dot{v}_c = \tau \dot{v}_c = \left[\frac{A}{\alpha A - 1} - 1\right] v_c = \frac{A - \alpha A + 1}{\alpha A - 1} \cdot v_c$$

$$\Rightarrow \boxed{v_c(t) = v_1 e^{\lambda t}} \quad (1)$$

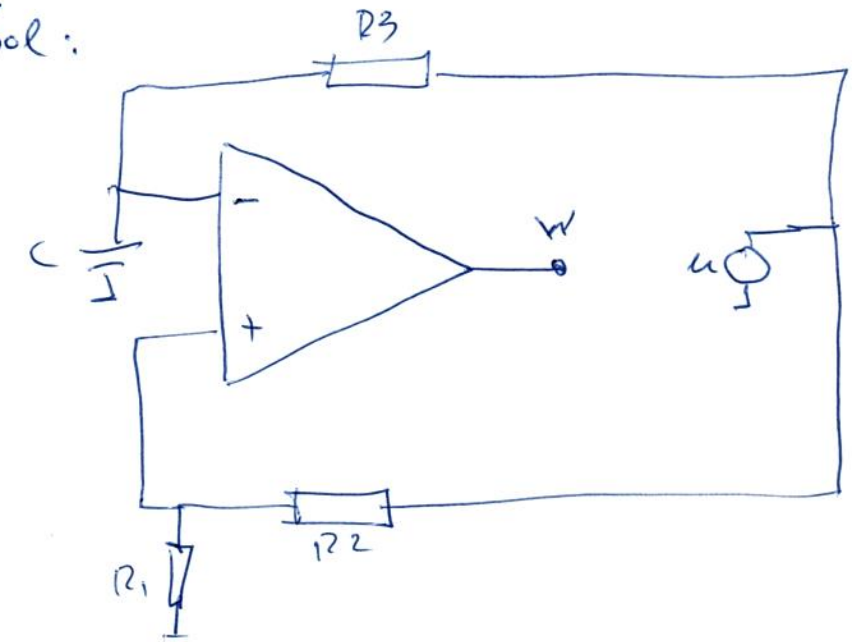
$$\lambda = \frac{\overbrace{\overbrace{A - \alpha A}^{>0} + 1}^{>0}}{\underbrace{\alpha A - 1}_{>0}} > 0.$$

$$\boxed{v_o(t) = \frac{A}{\alpha A - 1} v_1 e^{\lambda t}} \qquad \boxed{v_i = \left[\frac{\alpha A}{\alpha A - 1} - 1\right] v_1 e^{\lambda t}}$$

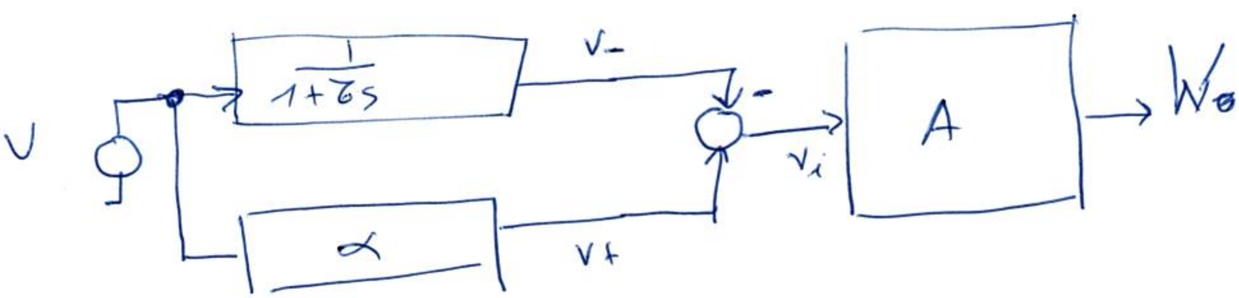
b. NO ES INTERNAMENTE ESTABLE. La respuesta (1) contradice la definición.

C.

Gol:



$$G_{ol} = \frac{W(s)}{U(s)}$$



$$\frac{\frac{1}{cs}}{\frac{1}{cs}+R_3} = \frac{1}{1+R_3 cs} = \frac{1}{1+\tau s}.$$

$$G_{ol} = \frac{W}{U} = A \cdot \left[\alpha - \frac{1}{1+\tau s}\right] = A\,\frac{\alpha\tau s + \alpha - 1}{\tau s + 1}$$

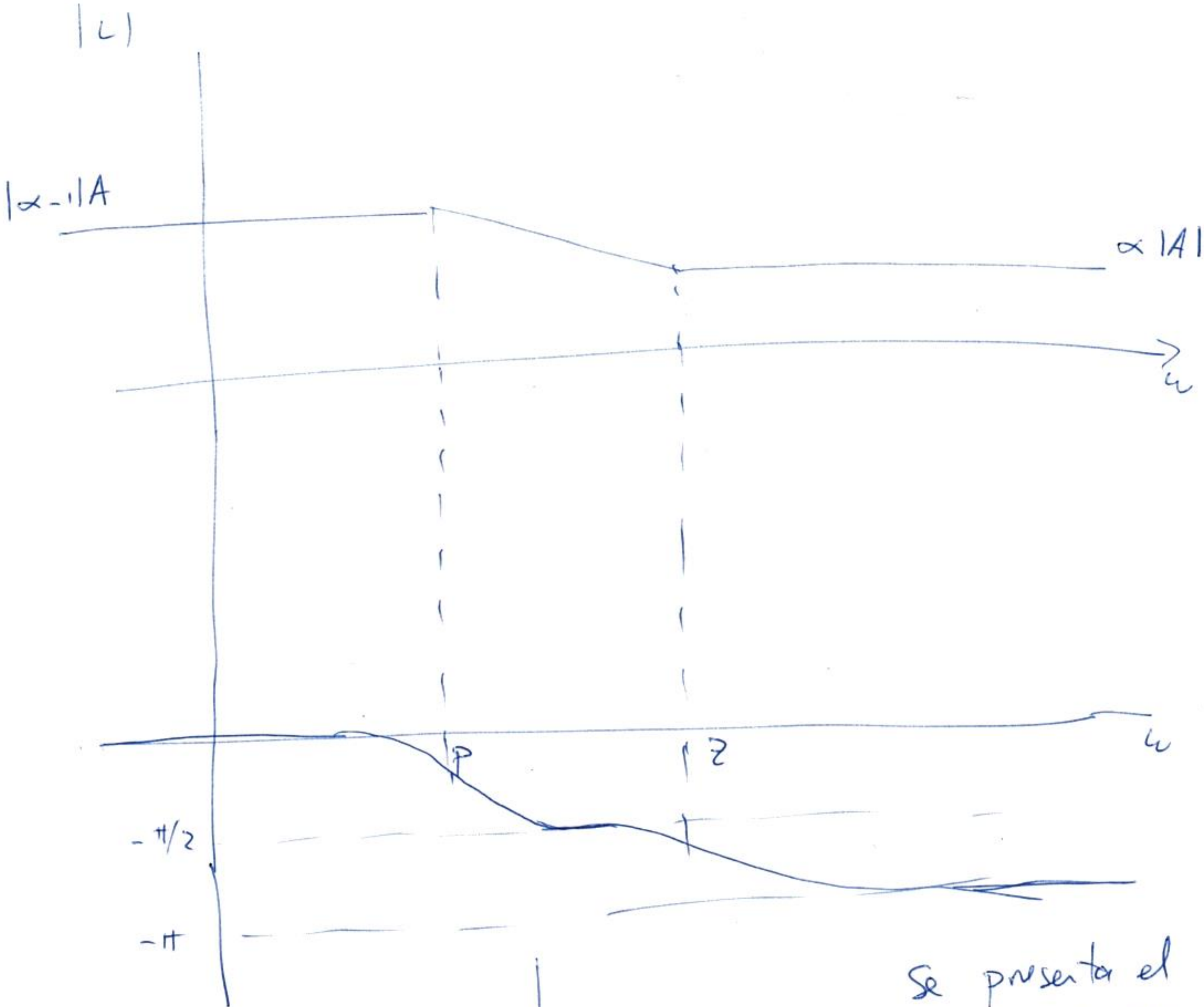
<0

$$L(s) = -G_{ol}(s) = -A\,\frac{\alpha\tau s + \alpha - 1}{\tau s + 1}$$

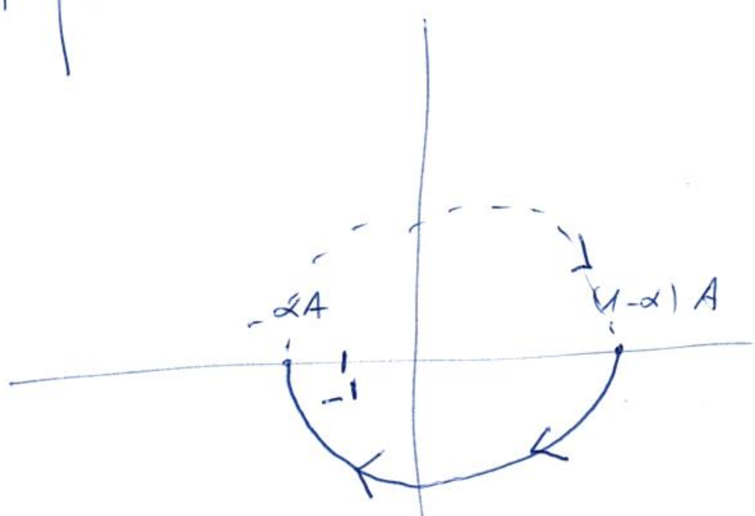
$$z = -\frac{\alpha - 1}{\alpha\tau} = -\frac{1}{\tau} + \frac{1}{\alpha\tau}$$

$$p = -\frac{1}{\tau}$$

$$\begin{cases} z > 0 \\ p < 0 \\ |z| \lessgtr |p| \end{cases}$$ ← pero no tiene relevancia mayor.



Se presenta el caso $|p| < |z|$ pero NO CAMBIA LA CONCLUSIÓN DE ESTABILIDAD



INESTABLE

pues $N = 1$

$N = Z - P \Rightarrow \underline{Z=1}$ INESTABLE

$P = 0$

para $\alpha A > 1$ (por hipótesis)

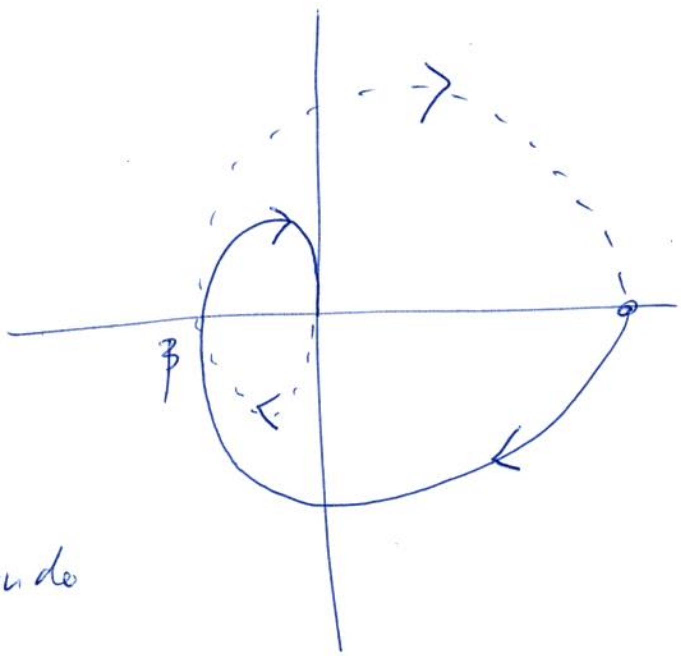
CONCUERDA CON PARTE 5.

d. $A(s) = \dfrac{A_0}{1+Ts}$ (4)

$$L(s) = -A_0 \frac{\alpha\tau s + \alpha - 1}{(\tau s+1)(Ts+1)} = -\frac{20}{21}\frac{A_0}{\tau}\frac{s - \frac{20}{\tau}}{(s+1/\tau)(s+\frac{20}{\tau})}$$

$$L(j0) = A_0(1-\alpha) > 0$$

$$L(j\infty) = 0\angle \pi/2$$



β se halla evaluando

$$L\left(j\frac{20}{\tau}\right)$$

$$L\left(j\frac{20}{\tau}\right) = \beta = -\frac{A_0}{21}$$

INESTABLE ssi $\dfrac{A_0}{21} \geq 1$.