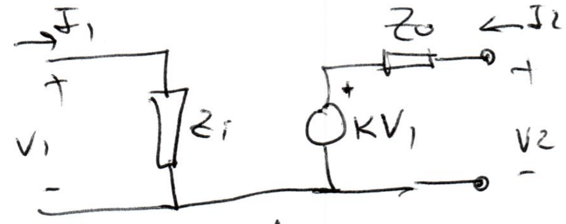
Problema 3. Dic 2017. Solución

I

a.

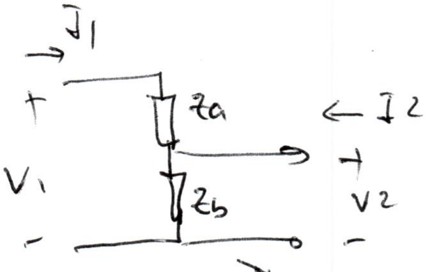


A.

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \mathbb{Z} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$\mathbb{Z}_A = \begin{bmatrix} z_i & 0 \\ kz_i & z_0 \end{bmatrix}$$

No Recíproco si $kz_i \neq 0$.

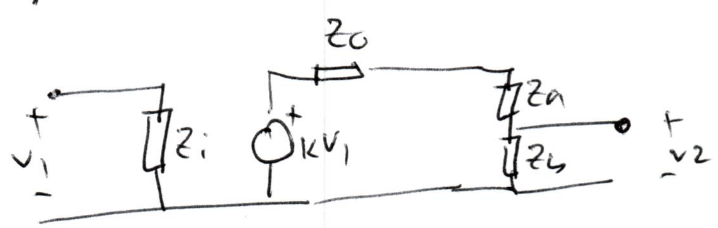


D

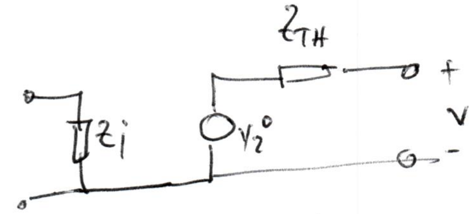
$$\mathbb{Z}_D = \begin{bmatrix} z_a+z_b & z_b \\ z_b & z_b \end{bmatrix}$$

Recíproco

b. AD



$\xrightarrow{th}$

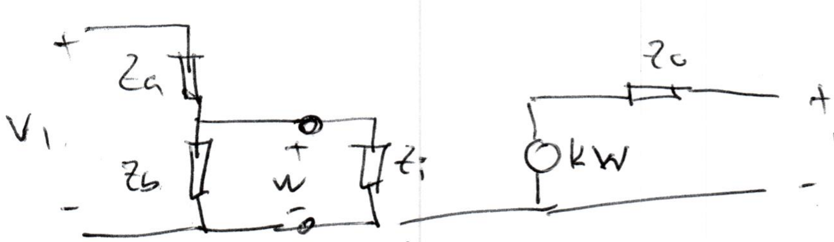


V_2 en vacío : $V_2^0 = \dfrac{z_b}{z_a+z_b+z_0} \cdot kV_1$

$Z_{TH} = z_b \,//\, z_a+z_0$

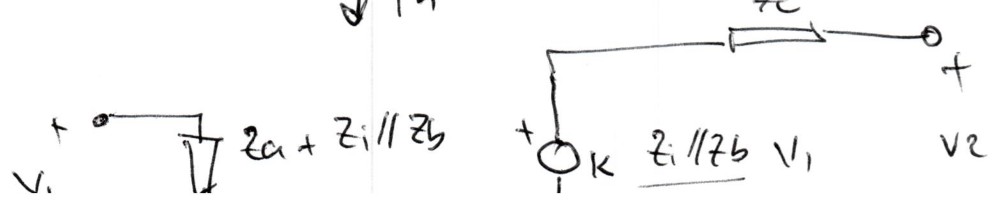
$$\mathbb{Z}_{AD} = \begin{bmatrix} z_i & 0 \\ \dfrac{k z_b z_i}{z_a+z_b+z_0} & z_b // z_a+z_0 \end{bmatrix}$$

DA



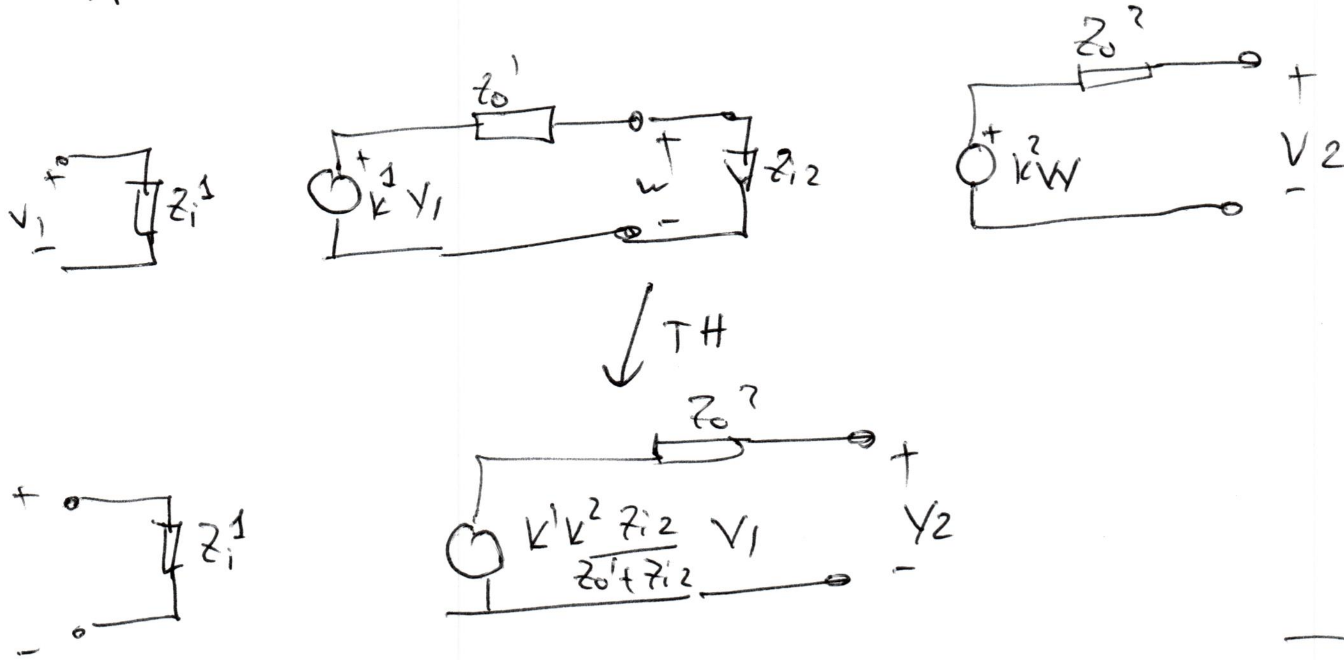
$\downarrow$ Th

$$\mathbb{Z}_{DA} = \begin{bmatrix} z_a + z_i // z_b & 0 \\ z_{21} & z_0 \end{bmatrix}$$



b. II

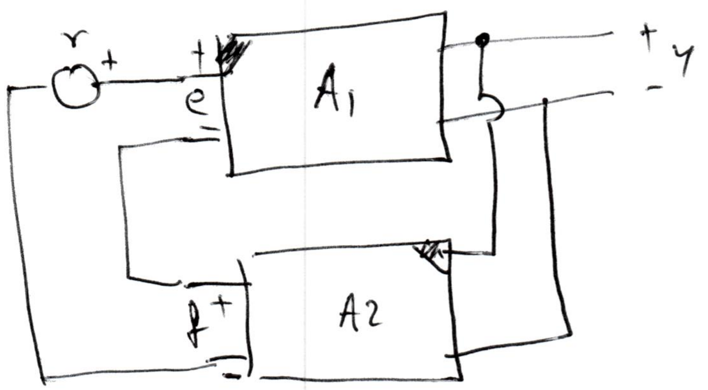
AA

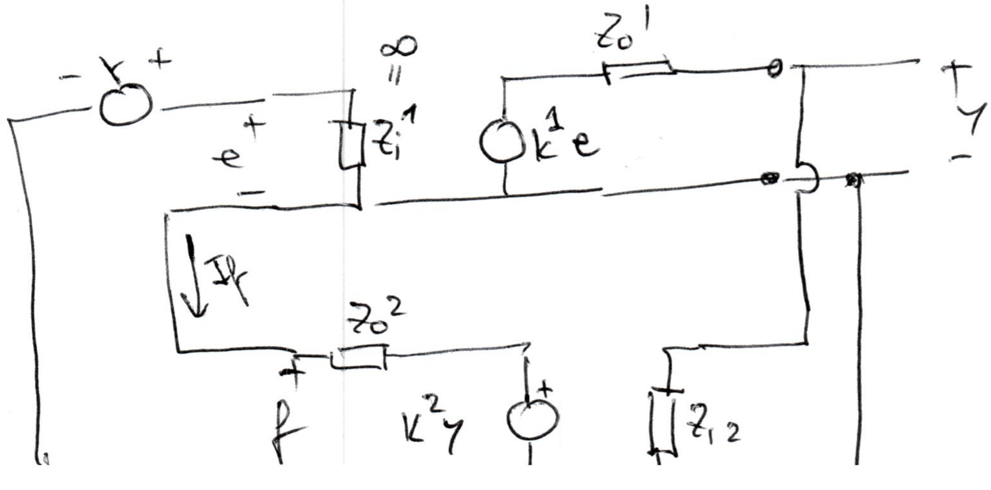


$$K^2 W = \frac{K^2 Z_{i2}}{Z_o^1 + Z_{i2}} K^1 V_1$$

$$Z_{AA} = \begin{bmatrix} Z_i^1 & 0 \\ \frac{K^1 K^2 Z_{i2} Z_{i1}}{Z_o^1 + Z_i^2} & Z_o^2 \end{bmatrix}$$

c





EN LA MALLA DE LA IZQUIERDA:

$$\boxed{E(s) = R(s) - F(s)} \quad (1)$$

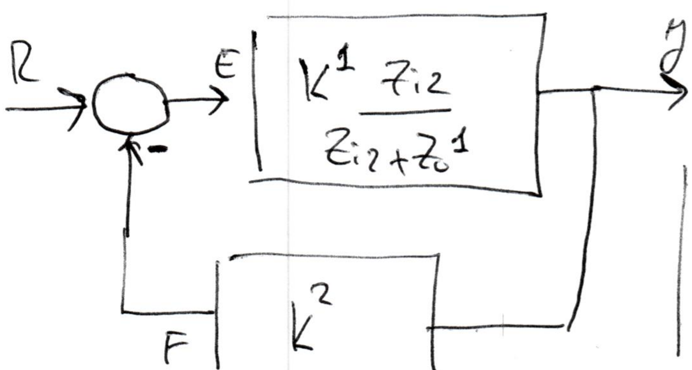
$I_f = 0$ ya que $Z_i^1 = \infty \Rightarrow F(s) = K^2\, Y(s)$

$$\boxed{C(s) = \frac{F(s)}{Y(s)} = K^2} \quad (2)$$

K^2 es la ganancia K del cuadripolo 2, y no $K \times K$!

$$Y(s) = K^1 E(s) \frac{Z_{i2}}{Z_{i2} + Z_o^1} \Rightarrow \boxed{H(s) = \frac{Y(s)}{E(s)} = \frac{K^1 Z_{i2}}{Z_{i2} + Z_o^1}} \quad (3)$$

El diagrama de bloques consiste en representar (1), (2), (3) gráficamente

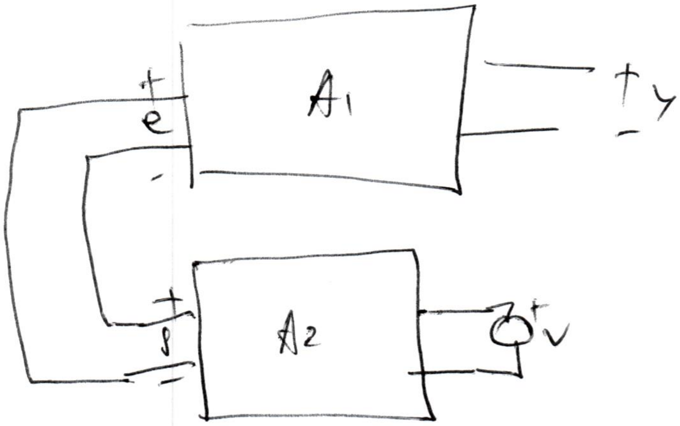


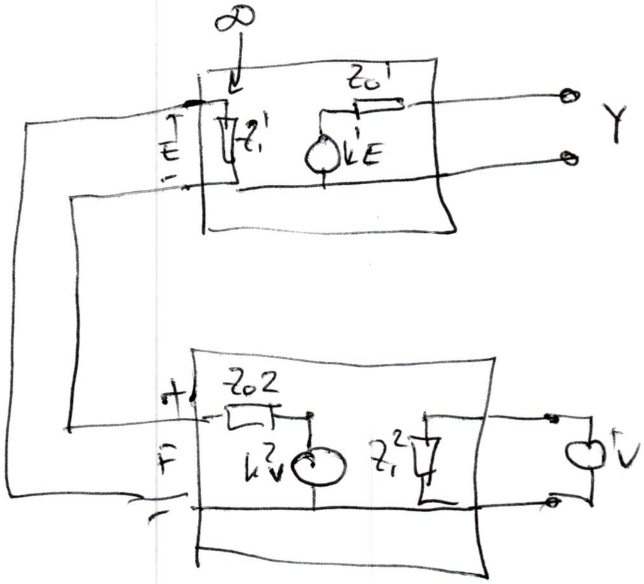
→ esquema standard de sistema realimentado.

$$\boxed{G_{ol} = -A\beta = -K^1 K^2 \frac{Z_{i2}}{Z_{i2} + Z_{o1}}}$$

e)

modo 1





$F = K^2 V$

$E = -F$

$Y = K^1 E$

$$\Rightarrow \boxed{\frac{Y}{V} = -K_1^1 K^2 = G_1}$$

$G_{ol} = G_1$ sólo si

$$\frac{Z_{i2}}{Z_{i2} + Z_{o1}} = 1$$

que ocurre sólo si $Z_{o1} = 0$ ó $Z_{i2} = \infty$.

modo 2

idem pero $Y(s) = \dfrac{Z_a}{Z_a + Z_o^1}$

y $\boxed{G_2 = -K^1 K^2 \dfrac{Z_a}{Z_a + Z_o^1}}$

$G_2 = G_{ol}$ si elegimos

$Z_a = Z_{i2}$