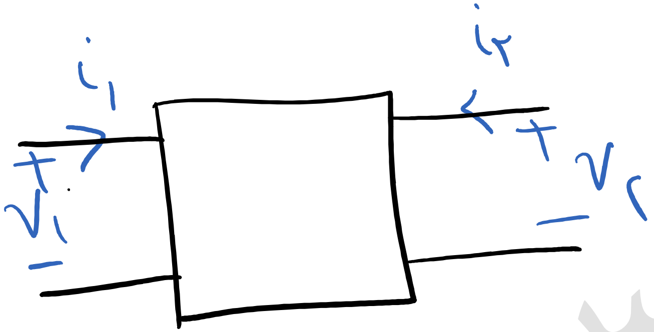
جلسه ۰۱



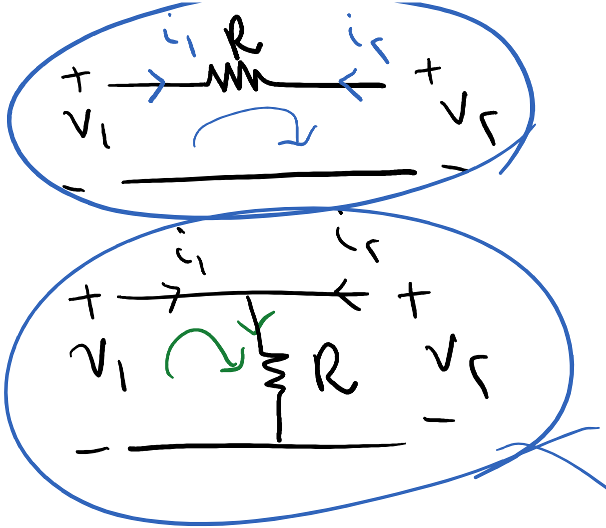
$$v_1 = z_{11} i_1 + z_{12} i_2$$

$$z_{11} = \frac{v_1}{i_1}\Big|_{i_2=0} \qquad z_{22} = \frac{v_2}{i_2}\Big|_{i_1=0}$$

$$z_{12} = \frac{v_1}{i_2}\Big|_{i_1=0} \qquad z_{21} = \frac{v_2}{i_1}\Big|_{i_2=0}$$

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$$

پاسخ — Z — ورودی



$$v_1 = R i_1 + v_2$$

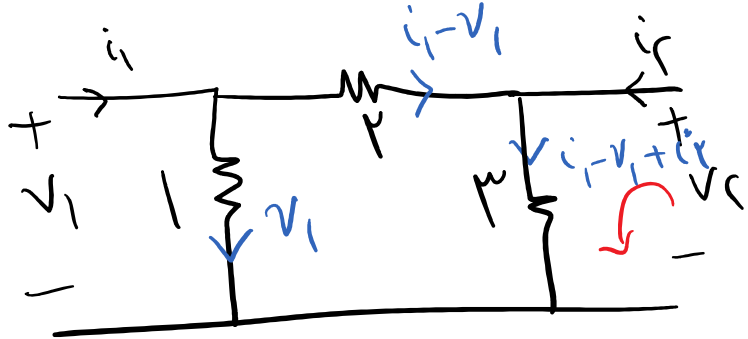
$$i_1 = -i_2$$

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} \; & \; \\ \; & \; \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$$

$$v_1 = v_2$$

$$v_1 = R i_1 + R i_2$$

$$Z = \begin{bmatrix} R & R \\ R & R \end{bmatrix}$$



$$v_۲ = ۳i_۱ - ۳v_۱ + ۳i_۲$$

$$v_۱ = ۲i_۱ - ۲v_۱ + v_۲ \Rightarrow ۳v_۱ = ۲i_۱ + v_۲$$

$$v_۲ = ۳i_۱ - ۲i_۱ - v_۲ + ۳i_۲$$

$$۲v_۲ = i_۱ + ۳i_۲ \Rightarrow \boxed{v_۲ = \frac{i_۱}{۲} + i_۲}$$

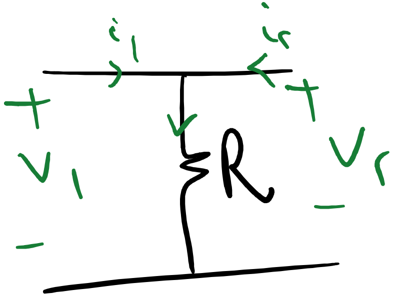
$$۳v_۱ = ۲i_۱ + \frac{i_۱}{۲} + i_۲ = \frac{۵}{۲}i_۱ + i_۲$$

$$\boxed{v_۱ = \frac{۵}{۶}i_۱ + \frac{i_۲}{۳}}$$

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} Z \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} \Rightarrow \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \underbrace{\begin{bmatrix} Z^{-1} \end{bmatrix}}_{Y} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \longrightarrow |A| = ad - bc$$

$$A^{-1} = \frac{1}{|A|} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

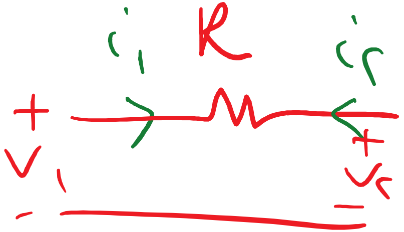


$$Z = \begin{bmatrix} R & R \\ R & R \end{bmatrix} \longrightarrow |Z| = 0$$

Y ناموجود

$$\begin{cases} V_1 = V_2 \\ V_1 = R(i_1) + R i_2 \end{cases}$$

$$\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} ? \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$



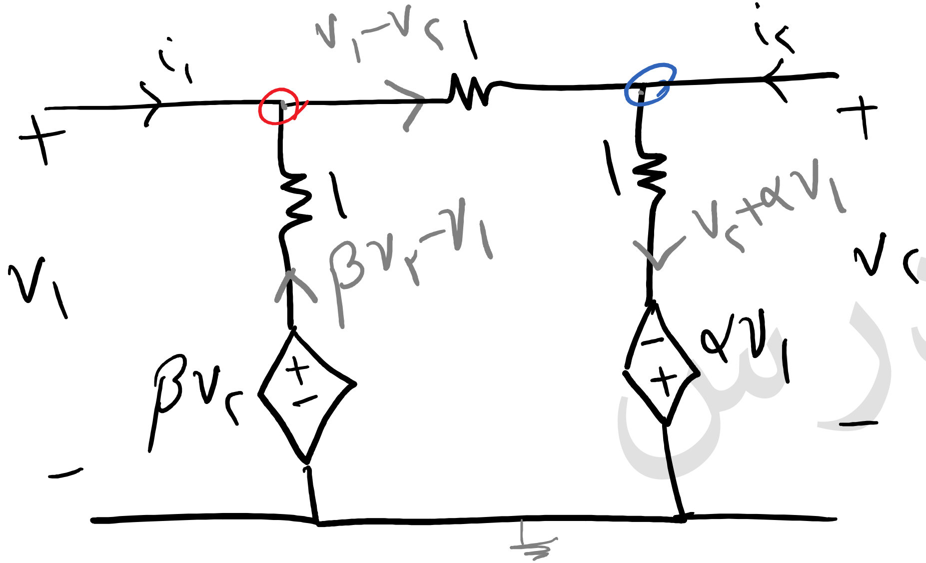
$$i_1 = -i_2$$

$$V_1 = R i_1 + V_2$$

$$i_1 = \frac{1}{R} V_1 - \frac{1}{R} V_2$$

$$i_2 = \frac{-1}{R} V_1 + \frac{1}{R} V_2$$

$$Y = \begin{bmatrix} \frac{1}{R} & -\frac{1}{R} \\ -\frac{1}{R} & \frac{1}{R} \end{bmatrix}$$



$$Y = \begin{bmatrix} 2 & -2 \\ 0 & 2 \end{bmatrix}$$

$$\beta = 1$$

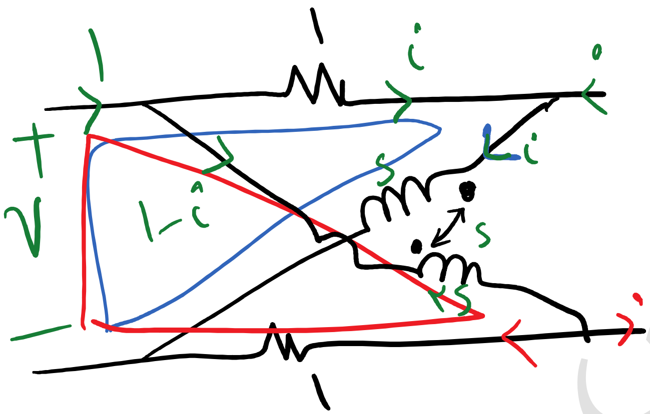
$$i_1 + \beta v_2 - v_1 = v_1 - v_2$$

$$i_1 = 2v_1 - (1+\beta) v_2$$

$$i_2 + v_1 - v_2 = v_2 + \alpha v_1$$

$$i_2 = (\alpha - 1) v_1 + 2v_2$$

$$\alpha = 1$$



$$z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0} \qquad I_1 = 1$$

$$v = i + si + s - si = i + s$$

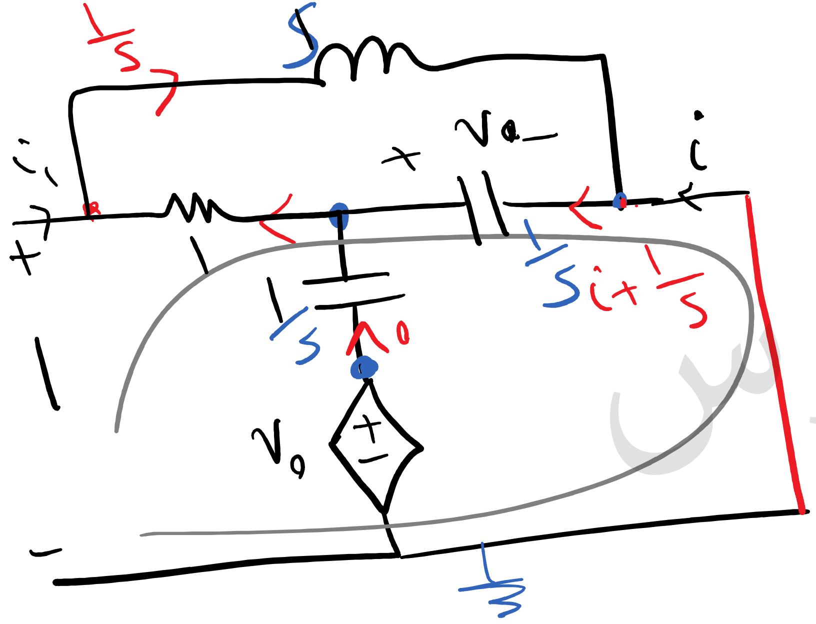
$$v = 2s - 2si + si + 1 - i$$

$$= 2s + 1 - i(s+1)$$

$$= 2s + 1 + (s - v)(s+1)$$

$$v(1 + s + 1) = s^2 + s + 2s + 1$$

$$\boxed{v = z_{11} = \frac{s^2 + 3s + 1}{s + 2}}$$



$$y_{21} = \frac{i_2}{1}\Big|_{v_2=0}$$

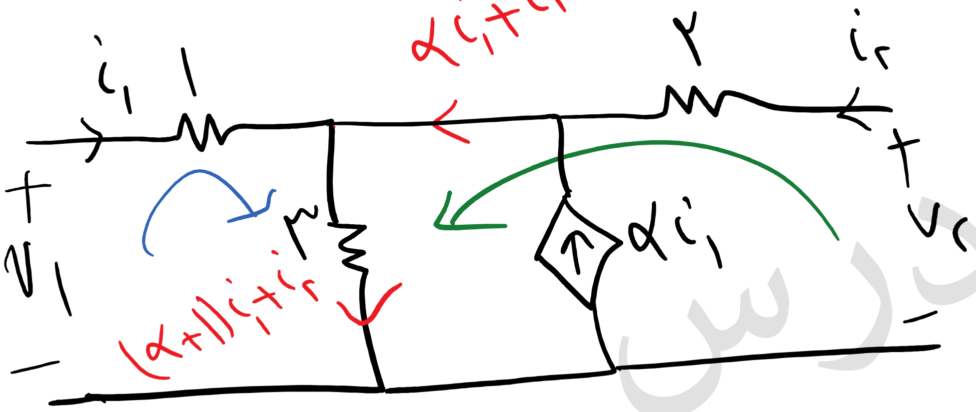
$$\frac{i}{s} + \frac{1}{s^2} + i + \frac{1}{s} + 1 = 0$$

$$si + 1 + s^2 i + s + s^2 = 0$$

$$i(s^2+s) = -(s^2+s+1)$$

$$i = y_{21} = \frac{s^2+s+1}{s(s+1)}$$

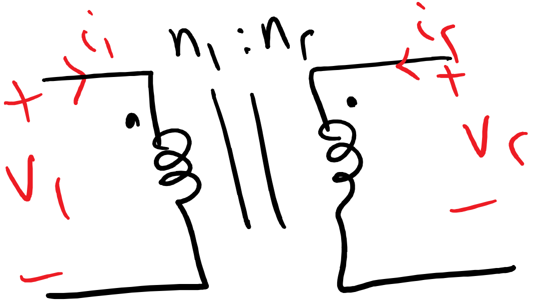
۲ نداشته باشه

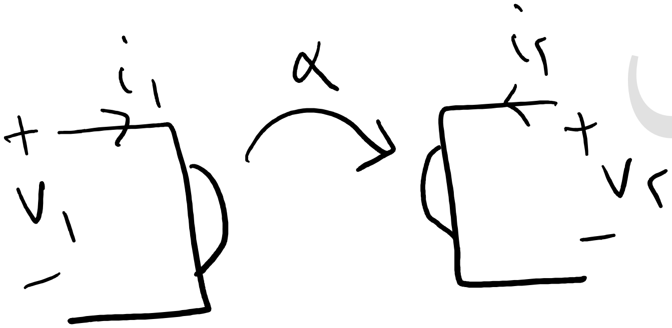


$$v_1 = i_1 + (3\alpha+3)i_1 + 3i_2$$
$$= (3\alpha+4)i_1 + 3i_2$$
$$v_2 = 2i_2 + 3i_2 + 3(\alpha+1)i_1$$

$$Z = \begin{bmatrix} 3\alpha+4 & 3 \\ 3\alpha+3 & 5 \end{bmatrix} \xrightarrow{|Z|=0} 15\alpha + 20 = 9\alpha + 9$$

$$\boxed{\alpha = \frac{-11}{6}}$$





$$\frac{v_2}{v_1} = \frac{n_2}{n_1}$$

$$\frac{i_1}{i_2} = -\frac{n_2}{n_1}$$

ژیراتور

$$v_1 = \alpha i_2 \rightarrow Z = \begin{bmatrix} 0 & \alpha \\ -\alpha & 0 \end{bmatrix}$$

$$v_2 = -\alpha i_1 \rightarrow Y = \begin{bmatrix} 0 & -\frac{1}{\alpha} \\ \frac{1}{\alpha} & 0 \end{bmatrix}$$

$$\begin{bmatrix} V_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 0 & \frac{n_1}{n_2} \\ -\frac{n_1}{n_2} & 0 \end{bmatrix} \begin{bmatrix} i_1 \\ V_2 \end{bmatrix}$$

$$i_2 = h_{21} i_1 \Big|_{V_2=0}$$

$$G^{-1} = H$$

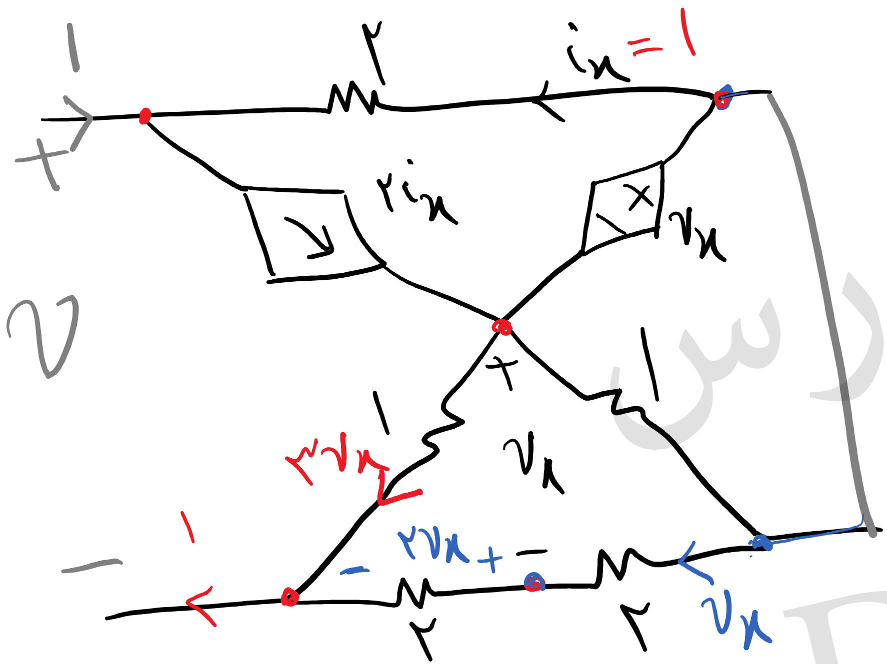
$$h_{21} = \frac{i_2}{i_1} \Big|_{V_2=0}$$

$$\begin{bmatrix} i_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} G \end{bmatrix} \begin{bmatrix} V_1 \\ i_2 \end{bmatrix}$$

$$\frac{V_2}{V_1} = \frac{n_2}{n_1}$$

$$\boxed{V_1 = \frac{n_1}{n_2} V_2}$$

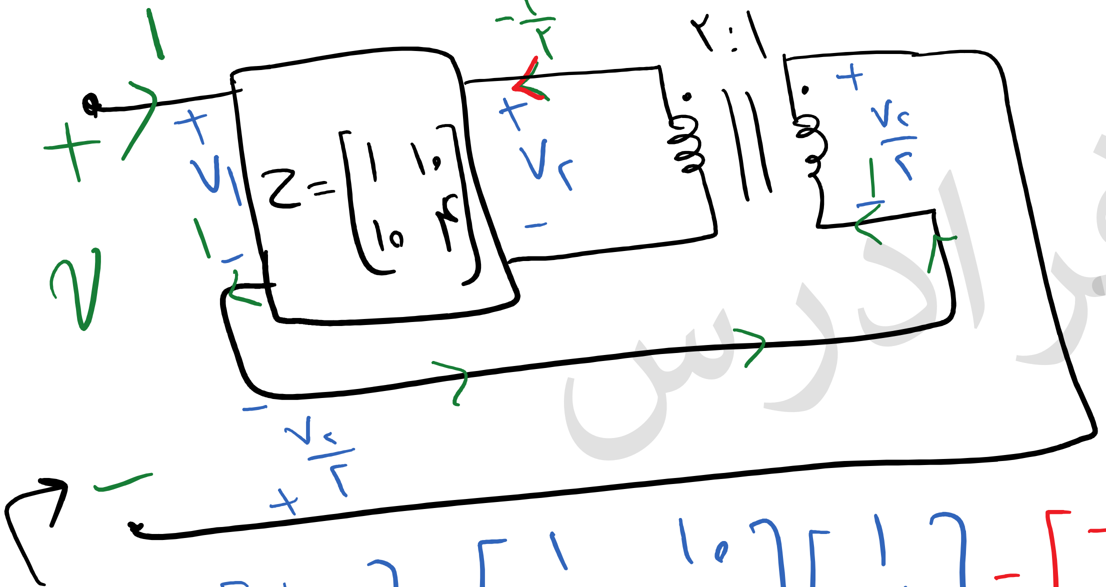
$$\frac{i_2}{i_1} = -\frac{n_1}{n_2} \Rightarrow \boxed{i_2 = -\frac{n_1}{n_2} i_1}$$



$$۴v_x = ۱$$

$$v = -۲ + ۲v_x + ۲v_x = -۱$$

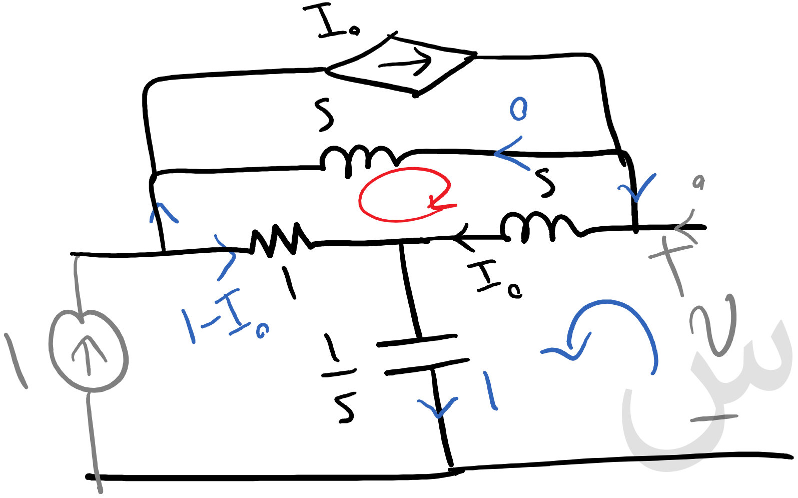
$$h_{11} = -۱$$



$$v = v_1 - \frac{v_2}{2}$$

$$-4 - 4 = -8$$

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 1 & 10 \\ 10 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ -\frac{1}{2} \end{bmatrix} = \begin{bmatrix} -4 \\ 8 \end{bmatrix}$$

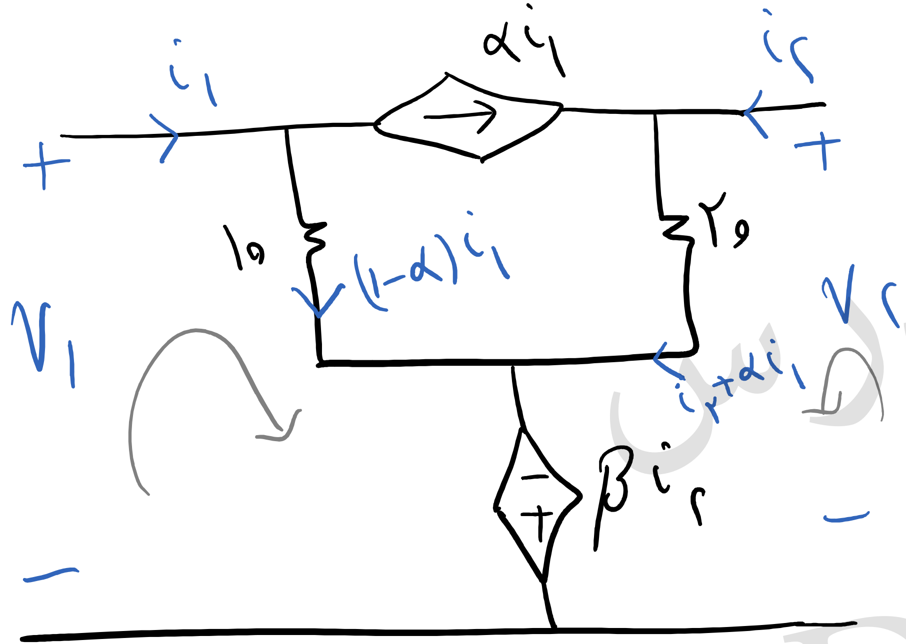


$$Z_{r1} = \frac{V_r}{i_1}\Big|_{i_r=0}$$

$$v = sI_o + \frac{1}{s}$$

$$sI_o = 1 - I_o \Rightarrow I_o = \frac{1}{s+1}$$

$$v = \frac{s}{s+1} + \frac{1}{s} = \frac{s^2+s+1}{s(s+1)}$$



$$h_{12} = h_{21} = 2$$

$$v_1 = (10 - 10\alpha) i_1 - \beta i_2$$

$$v_2 = 20\alpha i_1 + 20 i_2 - \beta i_2$$

$$h_{12} = \frac{v_1}{v_2}\Big|_{i_1=0} \qquad h_{21} = \frac{i_2}{i_1}\Big|_{v_2=0}$$

$$v_1 = -\beta i_2$$

$$v_2 = (20 - \beta) i_2$$

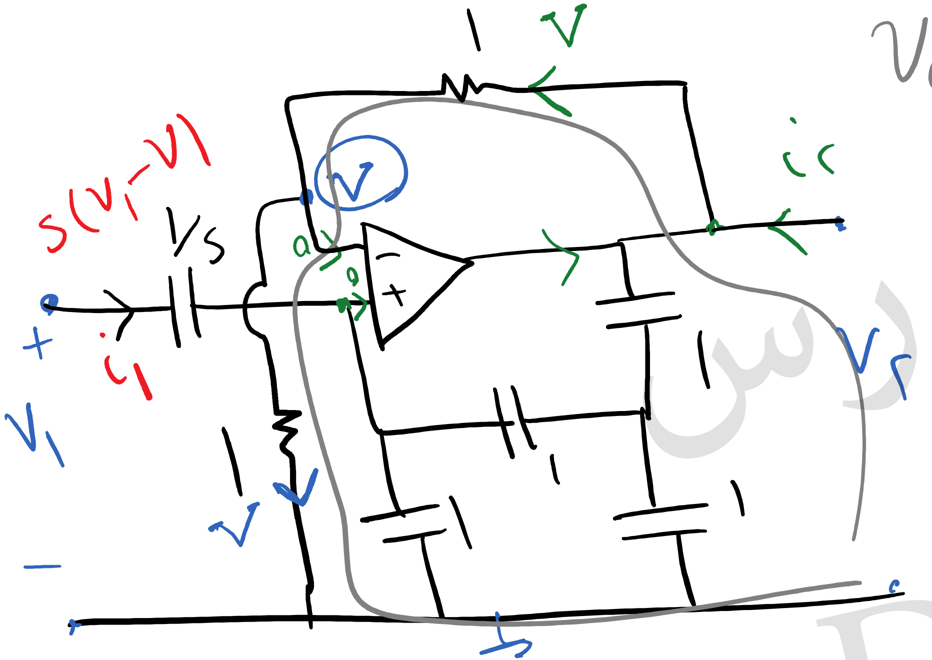
$$\frac{\beta}{\beta - 20} = 2$$

$$2\beta - 40 = \beta$$

$$\beta = 40$$

$$\alpha = 2$$

$$2 = \frac{20\alpha}{\beta - 20}$$



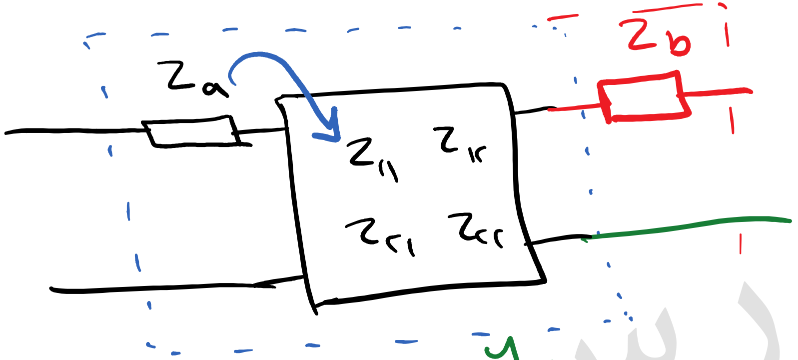
$$v_2 = 2v$$

$$v_1 - v = \frac{i_1}{s}$$

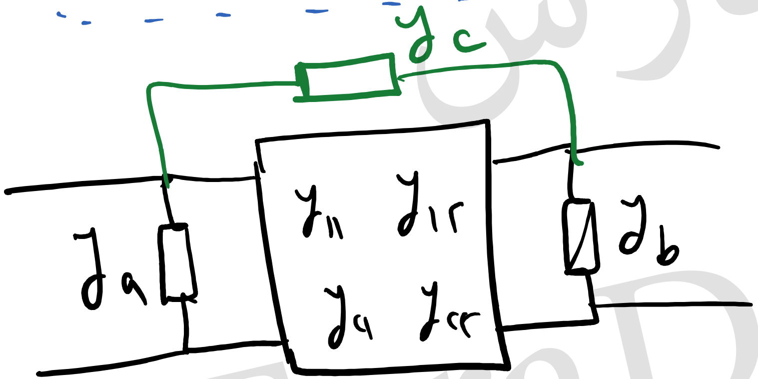
$$v_1 - \frac{v_2}{2} = \frac{i_1}{s}$$

$$\begin{bmatrix} \frac{1}{s} & 0 \\ \frac{2}{s} & 0 \end{bmatrix} \quad \begin{bmatrix} \frac{2}{s} & 0 \\ 0 & \frac{2}{s} \end{bmatrix}$$

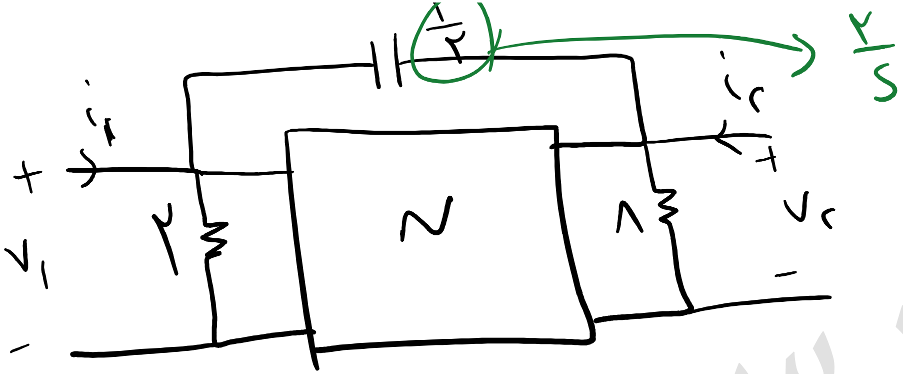
$$\begin{bmatrix} \frac{2}{s} & \frac{2}{s} \\ 0 & \frac{2}{s} \end{bmatrix} \quad \begin{bmatrix} 0 & \frac{2}{s} \\ \frac{2}{s} & 0 \end{bmatrix}$$



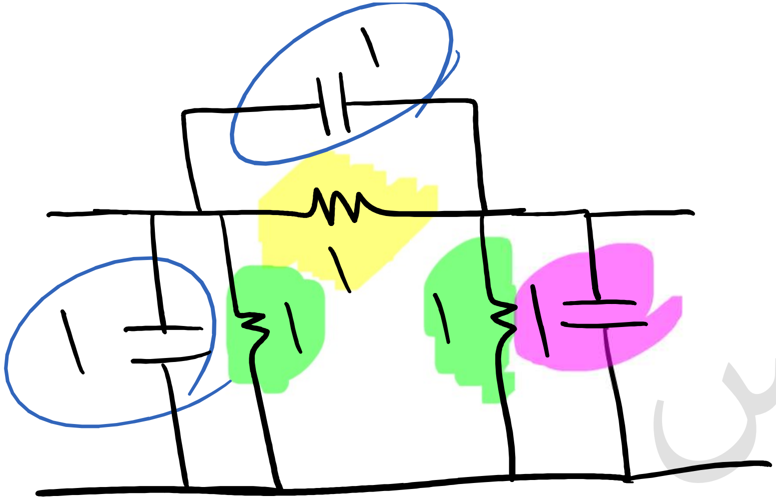
$$\begin{bmatrix} Z_{11}+Z_a & Z_{12} \\ Z_{21} & Z_{22}+Z_b \end{bmatrix}$$

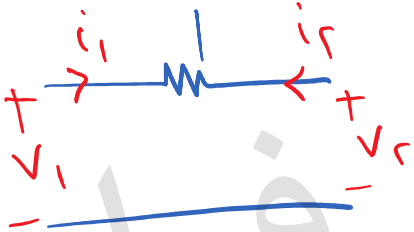


$$\begin{bmatrix} y_{11}+y_a+y_c & y_{12}-y_c \\ y_{21}-y_c & y_{22}+y_b+y_c \end{bmatrix}$$



$$Y=\begin{bmatrix} \frac{s}{2}+\frac{1}{2}+\frac{1}{2}+\frac{s}{2} & -\frac{s}{4}-\frac{1}{4}-\frac{s}{2} \\ -\frac{s}{4}-\frac{1}{4}-\frac{s}{2} & \frac{3}{8}s+\frac{3}{8}+\frac{1}{8}+\frac{s}{2} \end{bmatrix}$$





$$v_1 = i_1 + v_2$$

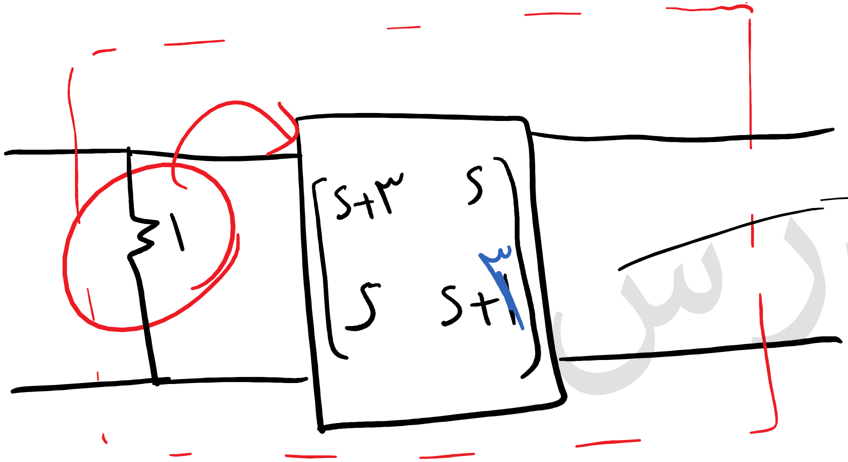
$$i_1 = v_1 - v_2$$

$$-i_1 = i_2 = -v_1 + v_2$$

$$\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$$

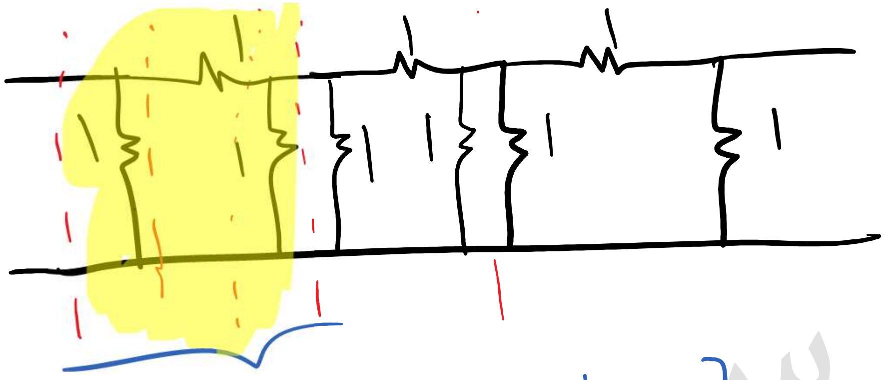
$$\begin{bmatrix} 1+1+s+s & -1-s \\ -1-s & 1+1+s+s \end{bmatrix}$$

$Y_{11} = ?$



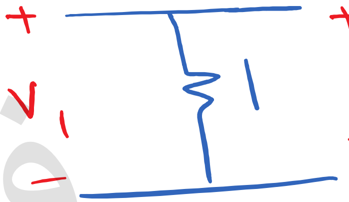
$$\begin{bmatrix} s+3 & s \\ s & s+1 \end{bmatrix} \rightarrow \frac{1}{6s+9}\begin{bmatrix} s+2 & -s \\ -s & s+2 \end{bmatrix}$$

$$\frac{s+3}{6s+9} + 1 = \frac{7s+12}{6s+9}$$



$$\begin{bmatrix}1&0\\1&1\end{bmatrix}\begin{bmatrix}1&1\\0&1\end{bmatrix}\begin{bmatrix}1&0\\1&1\end{bmatrix}$$

$$\begin{bmatrix}1&0\\1&1\end{bmatrix}\begin{bmatrix}2&1\\1&1\end{bmatrix}=\begin{bmatrix}2&1\\3&2\end{bmatrix}$$



$$\begin{bmatrix}1&0\\1&1\end{bmatrix}$$

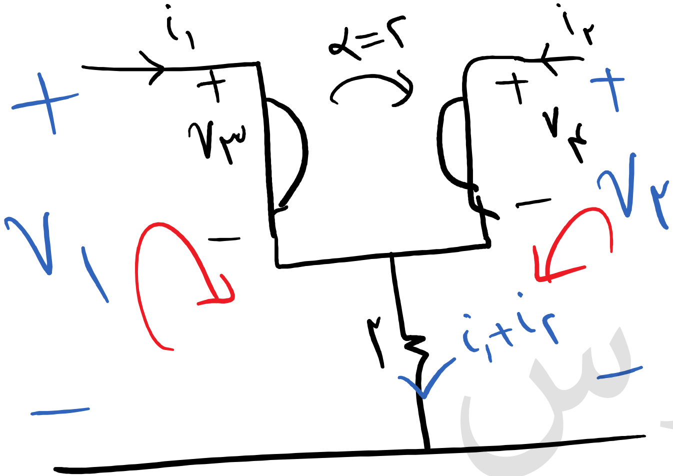
$v_1 = v_2 = i_1 + i_2$

$i_1 = v_2 - i_2$

$$\begin{bmatrix}1&1\\0&1\end{bmatrix}$$

$i_1 = -i_2$

$v_1 = -i_2 + v_2$



$$v_1 = -\frac{i_2}{2} + 2i_1 + 2i_2$$

$$v_2 = \frac{i_1}{2} + 2i_1 + 2i_2$$

$$\begin{bmatrix} v_1 \\ i_1 \end{bmatrix} = \begin{bmatrix} 0/18 & 0/1 \\ 0/4 & 0/18 \end{bmatrix} \begin{bmatrix} v_2 \\ -i_2 \end{bmatrix}$$

$$i_1 = 2v_4$$

$$i_2 = -2v_3$$

تقابل دو قطبی:

و هم با یکی

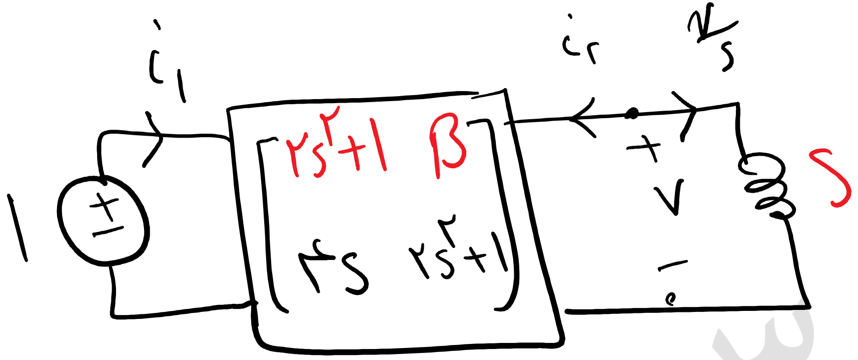
$$z_{12} = z_{21} \qquad y_{21} = y_{12} \qquad h_{12} = -h_{21}$$

$$\det\{T\} = 1 \qquad\qquad g_{12} = -g_{21}$$

$$z_{12} = z_{21}$$
$$z_{11} = z_{22}$$

متقارن دو قطبی:

$$\det T = 1, \quad A = D$$



$$H(s) = \frac{V}{1} = ?$$

$$(2s^2+1)^2 - 4sB = 1$$

$$4s^4 + 4s^2 + 1 - 4sB = 1$$

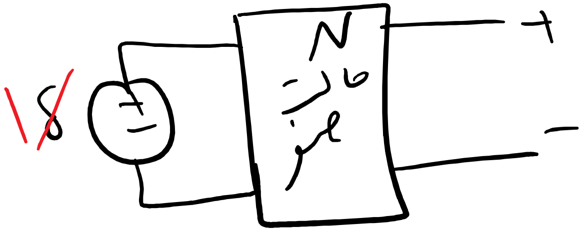
$$B = s^3 + s$$

$$\begin{bmatrix} 1 \\ i_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & A \end{bmatrix} \begin{bmatrix} V \\ \frac{V}{s} \end{bmatrix}$$

$$1 = \left(A + \frac{B}{s}\right) V$$

$$2s^2 + 1 + s^2 + 1 = 3s^2 + 2$$

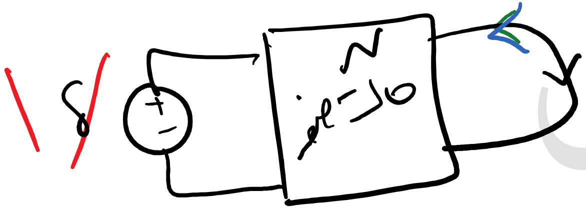
$$V = \frac{1}{3s^2 + 2}$$



$$e^{-t}u(t)$$

$$\frac{1}{s+1} = \alpha = \frac{V_2}{V_1}\Big|_{i_2=0}$$

$$\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{12} & y_{11} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} \qquad y_{11} = ?$$



$$(1-e^{-t})u(t)$$

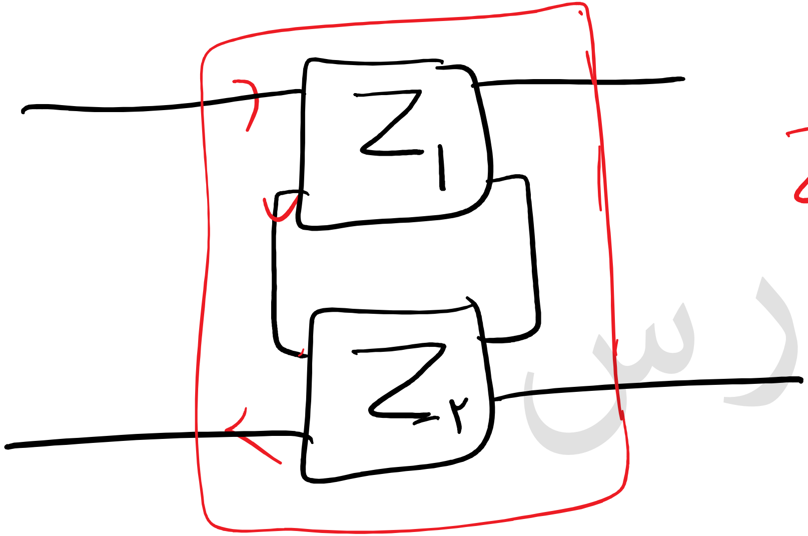
$$\frac{1}{s} - \frac{1}{s+1} = \beta = \frac{-i_2}{V_1}\Big|_{V_2=0}$$

$$i_2 = y_{12}V_1 + y_{11}V_2$$

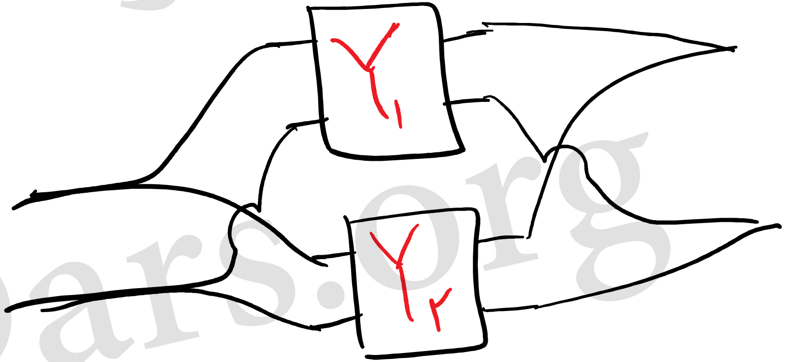
$$\alpha = -\frac{y_{12}}{y_{11}} = \frac{\beta}{y_{11}} \Rightarrow y_{11} = \frac{\beta}{\alpha}$$

$$\beta = -y_{12}$$

$$\frac{s+1}{s} - 1 = \frac{1}{s}$$



$Z = Z_1 + Z_2$



این اسلاید ها بر مبنای نکات مطرح شده در فرادرس

«آموزش مدارهای الکتریکی ۲»

تهیه شده است.

برای کسب اطلاعات بیشتر در مورد این آموزش به لینک زیر مراجعه نمایید

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