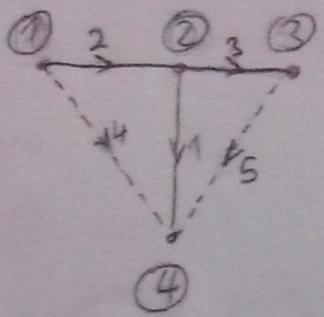
MATRICE

ORJENTIRANI GRAF



MATRICA INCIDENCIJE

$$A = \begin{array}{c} \\ \bar{c}_1 \\ \bar{c}_2 \\ \bar{c}_3 \\ \bar{c}_4 \end{array} \begin{array}{c} \overbrace{}^{A_b} \quad \overbrace{}^{A_g} \\ \begin{matrix} g_1 & g_2 & g_3 & g_4 & g_5 \end{matrix} \\ \left[\begin{matrix} 0 & 1 & 0 & 1 & 0 \\ 1 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 & 1 \\ -1 & 0 & 0 & -1 & -1 \end{matrix}\right] \end{array}$$

REDUCIRANI OBLIK A_b

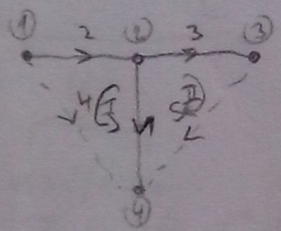
$g_1 + g_2 + g_3 \rightarrow$ STABLO

SVI ČVOROVI SU POVEZANI JEDNOSTAVNIM OTVORENIM PUTEM

SPOJNA MATRICA

S

PETLJE U SMJERU SPONA

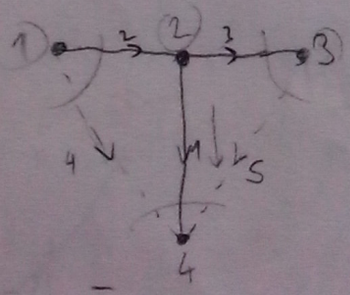


$$S = \begin{array}{c} \\ p_1 \\ p_2 \end{array} \begin{array}{c} \begin{matrix} g_1 & g_2 & g_3 & g_4 & g_5 \end{matrix} \\ \left[\begin{matrix} -1 & -1 & 0 & 1 & 0 \\ -1 & 0 & 1 & 0 & 1 \end{matrix}\right] \end{array}$$

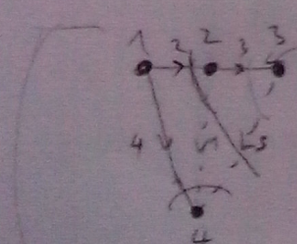
RASTAVNA MATRICA

Q

REZOVE RADIMO ZA ONE ČVOROVE STABLA KOJE DIRAJU BAREM 1 SPONA

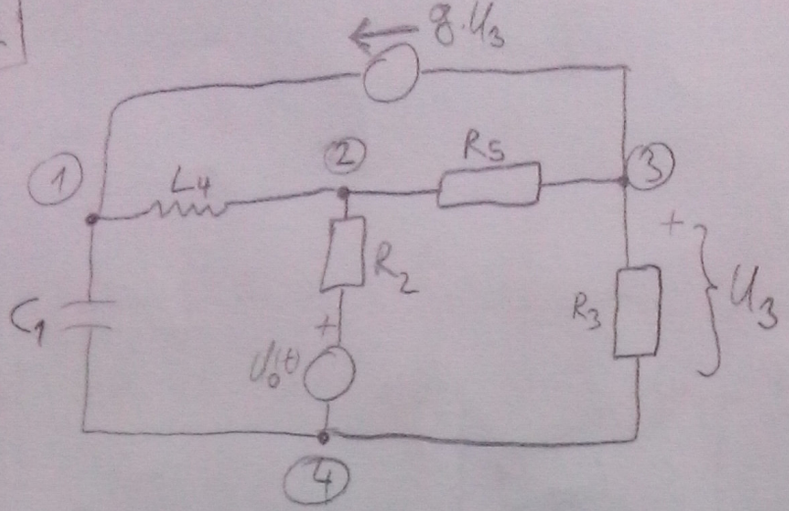


$$Q = \begin{array}{c} \\ r_1 \\ r_2 \\ r_3 \end{array} \begin{array}{c} \begin{matrix} g_1 & g_2 & g_3 & g_4 & g_5 \end{matrix} \\ \left[\begin{matrix} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & -1 \end{matrix}\right] \end{array}$$



$$Q = \begin{array}{c} \\ r_1 \\ r_2 \\ r_3 \end{array} \begin{array}{c} \begin{matrix} g_1 & g_2 & g_3 & g_4 & g_5 \end{matrix} \\ \left[\begin{matrix} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & -1 & 1 \\ 0 & 0 & 1 & 0 & -1 \end{matrix}\right] \end{array} ?$$

S1Z – 16 STR



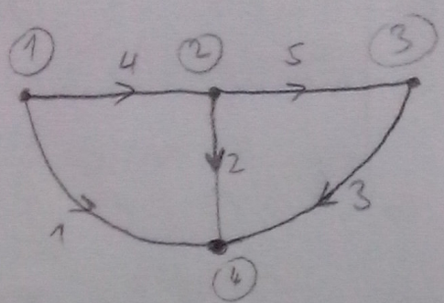
A_a=? INCIDENCIJE

S=? SPOJNA

Q=? RASTAVNA

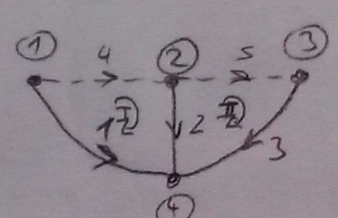
Z_b=? MATRICA IMPEDANCIJA GRANA

(8 STABLA 1,2,3)

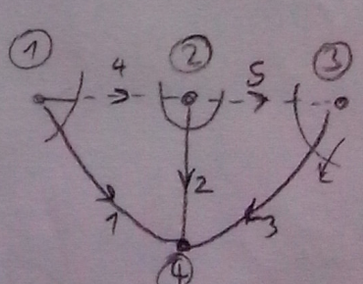


$$A_a = \begin{array}{c} \\ c_1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{ccccc} g_1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & -1 & 1 \\ 0 & 0 & 1 & 0 & -1 \\ -1 & -1 & -1 & 0 & 0 \end{bmatrix} \end{array}$$

$$S = \begin{array}{c} \\ P_1 \\ 2 \end{array} \begin{array}{c} \begin{array}{ccccc} g_1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} -1 & 1 & 0 & 1 & 0 \\ 0 & -1 & 1 & 0 & 1 \end{bmatrix} \end{array}$$

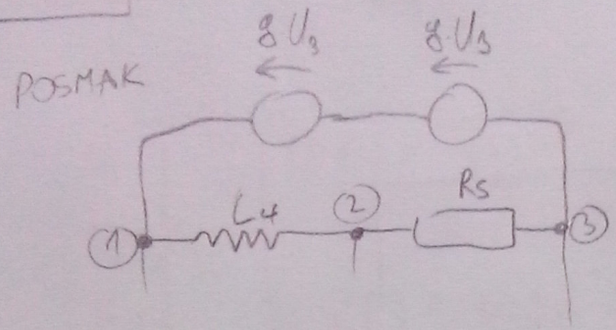


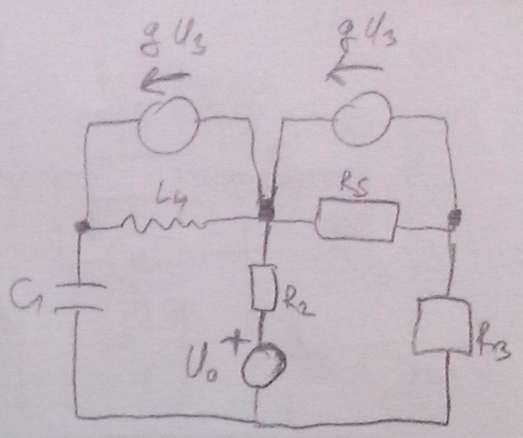
$$Q = \begin{array}{c} \\ T_1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccccc} g_1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & -1 & 1 \\ 0 & 0 & 1 & 0 & -1 \end{bmatrix} \end{array}$$



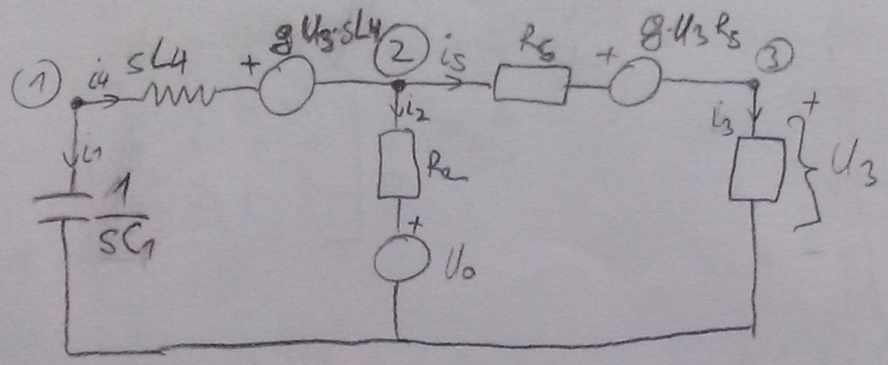
SIZ – SZ16

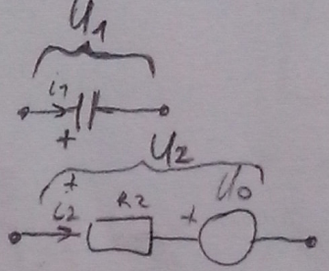
POSMAK





$$I = \frac{U}{R} \Rightarrow U = I \cdot R$$





$$U_1 = I_1 \cdot \frac{1}{sC_1}$$

$$U_2 = I_2 \cdot R_2 + U_0 \qquad I_2 R_2 + U_0 - U_2 = \vec{0}$$

$$U_3 = I_3 R_3$$

$$U_4 = I_4 \cdot sL_4 + g \cdot U_3 \cdot sL_4 = I_4 \cdot sL_4 + I_3 \cdot g \cdot R_3 \cdot sL_4 \quad (I_3 R_3)$$

$$U_5 = I_5 \cdot R_5 + g \cdot U_3 \cdot R_5 = I_5 \cdot R_5 + I_3 \cdot R_5 g \cdot R_3$$

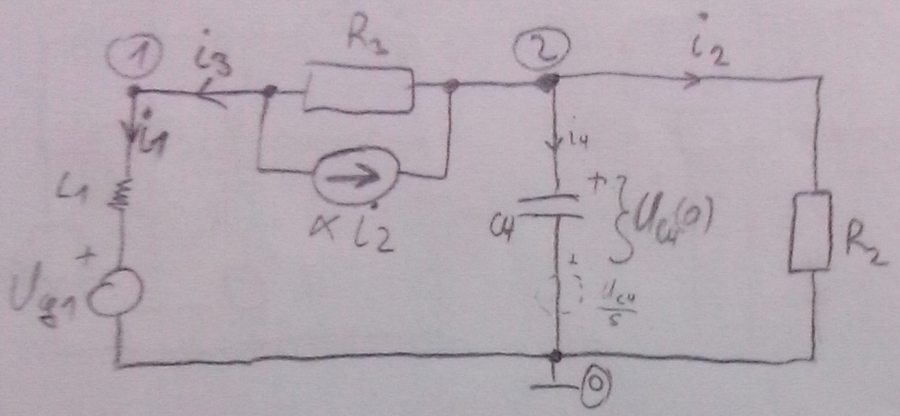
$$U_b = Z_b \cdot I_b + U_{ob}$$

$$\begin{bmatrix} U_1 \\ U_2 \\ U_3 \\ U_4 \\ U_5 \end{bmatrix} = \begin{bmatrix} \frac{1}{sC_1} & 0 & 0 & 0 & 0 \\ 0 & R_2 & 0 & 0 & 0 \\ 0 & 0 & R_3 & 0 & 0 \\ 0 & 0 & g \cdot R_3 \cdot sL_4 & sL_4 & 0 \\ 0 & 0 & g \cdot R_3 \cdot R_5 & 0 & R_5 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \end{bmatrix} + \begin{bmatrix} 0 \\ U_0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

Z REGULARNA

DET |Z| ≠ 0

P1 - 2010/11 - 2



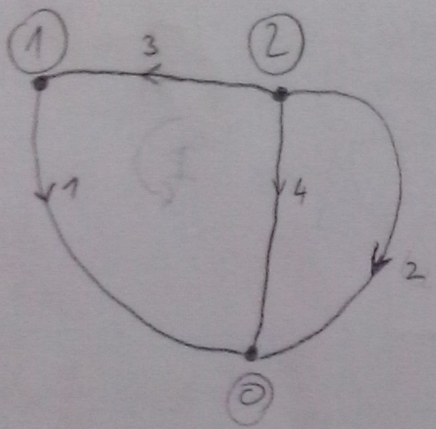
$A_a = ?$

$S = ?$

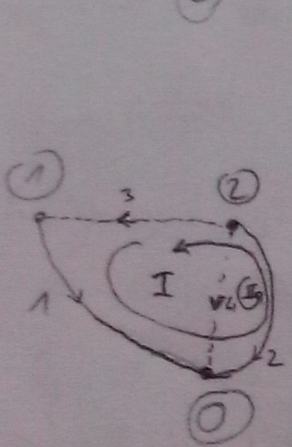
$Q = ?$

$Z_b = ?$ $U_{ob} = ?$

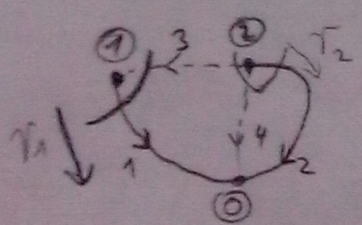
$Y_b = ?$ $I_{ob} = ?$



$$A_a = \begin{array}{c} \\ i_1 \\ 2 \\ 0 \end{array} \begin{array}{c} \begin{array}{cccc} g1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 1 & 1 \\ -1 & -1 & 0 & -1 \end{bmatrix} \end{array}$$



$$S = \begin{array}{c} \\ p1 \\ p2 \end{array} \begin{array}{c} \begin{array}{cccc} g1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 1 & -1 & 1 & 0 \\ 0 & -1 & 0 & 1 \end{bmatrix} \end{array}$$



$$Q = \begin{array}{c} \\ r_1 \\ r_2 \end{array} \begin{array}{c} \begin{array}{cccc} g & 1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix} \end{array}$$

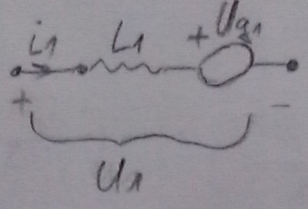
P1-2010/11-2

$$U_b = z_b \cdot I_b + U_{ob}$$

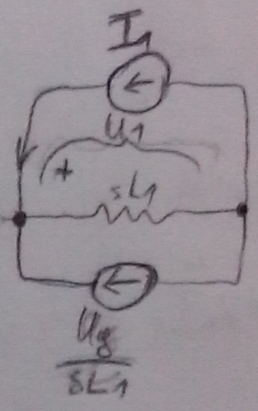
$$\begin{bmatrix} U_1 \\ U_2 \\ U_3 \\ U_4 \end{bmatrix} = \begin{bmatrix} sL_1 & I_1 & 0 & 0 & 0 \\ 0 & R_2 & 0 & 0 \\ 0 & \alpha R_2 & R_3 & 0 \\ 0 & 0 & 0 & \frac{1}{sC_4} \end{bmatrix} \cdot \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} + \begin{bmatrix} U_{g1} \\ 0 \\ 0 \\ \frac{U_{c4}(0)}{s} \end{bmatrix}$$

$$I_b = Y_b \cdot U_b + I_{ob}$$

$$I_1 = \frac{1}{sL_1} U_1 - \frac{U_{g1}}{sL_1}$$



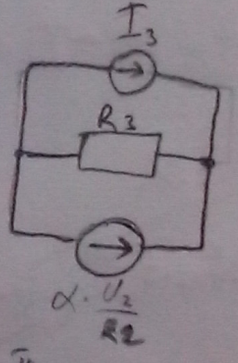
$\Rightarrow$



$$U_1\left(\frac{1}{sL_1}\right) = I_1 + \frac{U_g}{sL_1}$$

$$I_2 = \frac{U_2}{R_2}$$

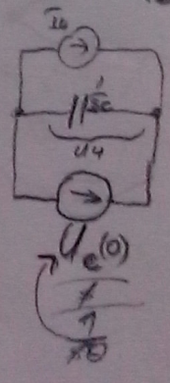
$$I_3 = U_3 \cdot \frac{1}{R_3} - \alpha \, U_2 \cdot \frac{1}{R_2}$$



$$I_4 = U_4 \cdot sC - C U_c(0)$$

$$I_b = Y_b \cdot U_b + I_{ob}$$

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} \frac{1}{sL_1} & 0 & 0 & 0 \\ 0 & \frac{1}{R_2} & 0 & 0 \\ 0 & \frac{\alpha}{R_2} & \frac{1}{R_3} & 0 \\ 0 & 0 & 0 & sC_4 \end{bmatrix} \cdot \begin{bmatrix} U_1 \\ U_2 \\ U_3 \\ U_4 \end{bmatrix} + \begin{bmatrix} -\frac{U_g}{sL_1} \\ 0 \\ 0 \\ -C_4 U_{c4}(0) \end{bmatrix}$$



$$Y_V = Q \cdot Y_b \cdot Q^T \qquad I_{ob} = -Q \cdot I_{ob}$$

M1-2012/13-3

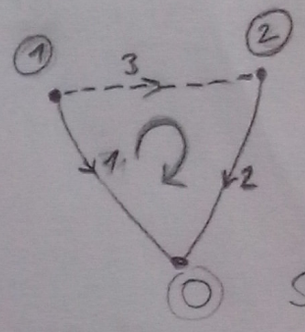
$$Z_b = \begin{bmatrix} R & 0 & 0 \\ \mu R & \frac{1}{sC} & 0 \\ 0 & 0 & sL \end{bmatrix} \qquad U_{ob} = \begin{bmatrix} 0 \\ \frac{u_C(0)}{s} \\ -I_0 sL + L i_L(0) \end{bmatrix} \qquad A = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & -1 \\ 0 & -1 & -1 & 0 \end{bmatrix} \end{array}$$

$$\begin{bmatrix} U_1 \\ U_2 \\ U_3 \end{bmatrix} = \begin{bmatrix} R & 0 & 0 \\ \mu R & \frac{1}{sC} & 0 \\ 0 & 0 & sL \end{bmatrix} \cdot \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{u_C(0)}{s} \\ -I_0 sL + L i_L(0) \end{bmatrix}$$

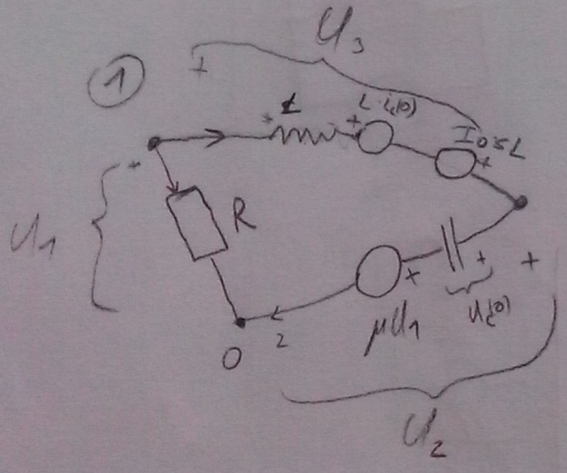
$$U_1 = I_1 \cdot R$$

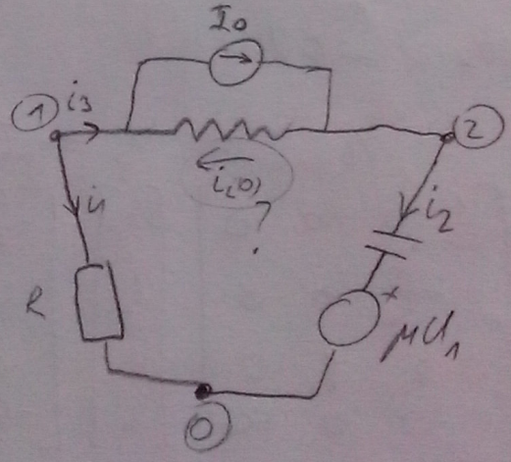
$$U_2 = \mu R I_1 + I_2 \frac{1}{sC} + \frac{u_C(0)}{s} \qquad (U_1 = R I_1)$$

$$U_3 = I_3 sL + L i_L(0) - I_0 sL$$

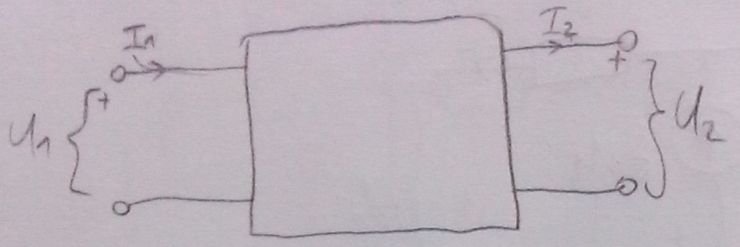


$S = [-1 \; 1 \; 1]$





ČETVEROPOLI



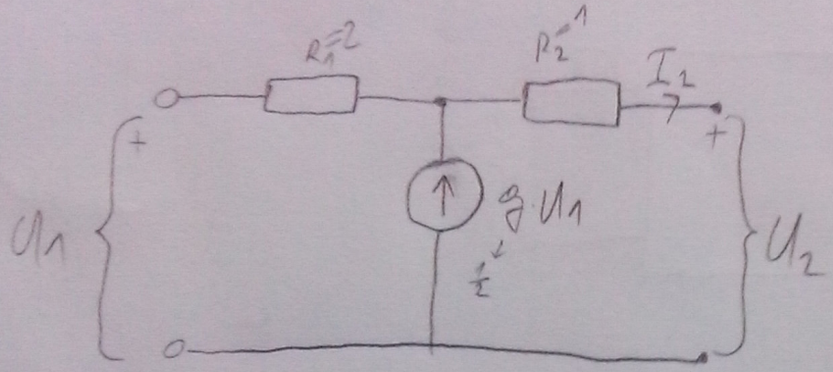
$$\begin{bmatrix} x \\ x \end{bmatrix} = \begin{bmatrix} \quad \end{bmatrix} \begin{bmatrix} y \\ y \end{bmatrix}$$

$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} Y \end{bmatrix} \begin{bmatrix} U_1 \\ U_2 \end{bmatrix}$$

$$\begin{bmatrix} U_1 \\ U_2 \end{bmatrix} = \begin{bmatrix} Z \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$\begin{bmatrix} U_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} a \end{bmatrix} \begin{bmatrix} U_2 \\ I_2 \end{bmatrix}$$

E1 2012/13



[a] PARAMETRI = ?

$$\begin{bmatrix} U_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \cdot \begin{bmatrix} U_2 \\ I_2 \end{bmatrix}$$

$U_1 = AU_2 + BI_2$

$I_1 = CU_2 + DI_2$

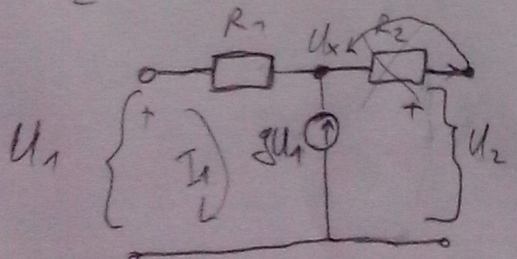
$\boxed{I_2 = 0} \Rightarrow U_1 = AU_2 \quad A = \frac{U_1}{U_2}$

$I_1 = CU_2 \quad C = \frac{I_1}{U_2}$

$\boxed{U_2 = 0} \Rightarrow U_1 = B \cdot I_2 \quad B = \frac{U_1}{I_2}$

$I_1 = D I_2 \quad D = \frac{I_1}{I_2}$

a) $I_2 = 0$



$U_x = U_2$

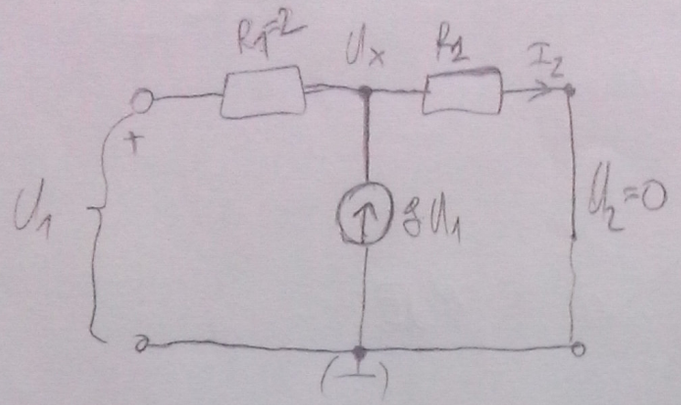
$U_x\left(\frac{1}{R_1}\right) - U_1\left(\frac{1}{R_1}\right) = g \cdot U_1$

$U_2\left(\frac{1}{R_1}\right) = U_1\left(g + \frac{1}{R_1}\right) \Rightarrow U_2 \cdot \frac{1}{2} = U_1$

$I_1 = \frac{U_1 - U_2}{R_1} = \frac{\frac{1}{2}U_2 - U_2}{2} = \frac{-\frac{1}{2}}{2} = \boxed{\frac{1}{4}} = C$

$\frac{U_1}{U_2} = \frac{\frac{1}{R_1}}{g + \frac{1}{R_1}} = \frac{\frac{1}{2}}{1} = \frac{1}{2} = A$

b) $U_2 = 0$



$U_1 = B \cdot I_2$

$U_x\left(\frac{1}{R_1}+\frac{1}{R_2}\right) - U_1\left(\frac{1}{R_1}\right) = g \cdot U_1$

$U_x \left(\frac{3}{2}\right) = U_1\left(g+\frac{1}{R_1}\right) = U_1$

$U_x = \frac{2}{3} U_1$

$U_x = I_2 \cdot R_2$

$I_2 \cdot R_2 = \frac{2}{3} U_1$

$B = \frac{U_1}{I_2} = \frac{3}{2} \cdot R_2 = \frac{3}{2}$

$D = \frac{I_1}{I_2}$ $I_1 = \frac{U_1 - U_x}{R_1} \Rightarrow$ $U_x = \frac{2}{3} U_1$

$I_1 R_1 = U_1 - U_x = U_1\left(1-\frac{2}{3}\right) = \frac{1}{3} U_1$

$I_1 \cdot 2 \cdot 3 = U_1$

$I_1 = \frac{1}{6} U_1$

$D = \frac{I_1}{I_2} = \frac{\frac{1}{6} U_1}{I_2} = \frac{3}{12} = \frac{1}{4}$

$$[O\mathcal{U}] = \begin{bmatrix} \frac{1}{2} & \frac{3}{2} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix}$$

$$[a] = \begin{bmatrix} \frac{1}{2} & \frac{3}{2} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix}$$

RECIPROČAN? SIMETRIČAN?

SIMETRIČAN

$A = D$ ~~$\frac{1}{2} \neq \frac{1}{4}$~~ NIJE

RECIPROČAN

$|a| = 1a \begin{vmatrix} \frac{1}{2} & \frac{3}{2} \\ -\frac{1}{4} & \frac{1}{4} \end{vmatrix} = \frac{1}{8} + \frac{3}{8} = \frac{1}{2}$ X NIJE

$Z_{UL} = ?$

$$Z_{UL} = \frac{U_1}{I_1} = \frac{AZ_2 + B}{CZ_2 + D} \overset{Z_2 = R_L}{=} \frac{\frac{1}{2} + \frac{3}{2}}{-\frac{1}{4} + \frac{1}{4}} = \frac{2}{0} = \infty$$

$$H(s) = \frac{U_2(s)}{U_g(s)} = \frac{Z_L}{AZ_L + B + Z_s(CZ_L + D)} = \frac{1}{\frac{1}{2} + \frac{3}{2} + 1\left(-\frac{1}{4} + \frac{1}{4}\right)} = \frac{1}{2}$$