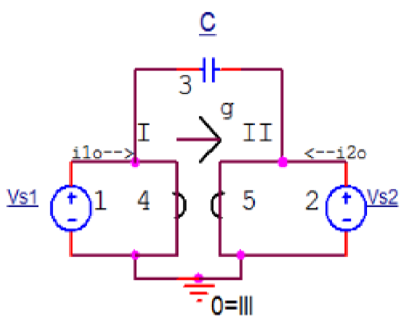
ENEE 610
09/10/20

Note Title 8/31/2020

Try to choose a base paper over the weekend   Blank 2



$$\begin{bmatrix} 1 & 0 & \vdots & 0 & 0 & 0 \\ 0 & 1 & \vdots & 0 & 0 & 0 \\ \alpha C & -\alpha C & \vdots & -1 & 0 & 0 \\ 0 & -g & \vdots & 0 & -1 & 0 \\ g & 0 & \vdots & 0 & 0 & -1 \end{bmatrix} x = \begin{bmatrix} v_{A1} \\ v_{A2} \\ 0 \\ 0 \\ 0 \end{bmatrix} \qquad -\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & -1 & 0 & 1 \end{bmatrix} x$$

$$AC^T v_t - BJ^T i_\ell$$

$x = \begin{bmatrix} v_t \\ i_\ell \end{bmatrix}$, t+l vector $= b$

multiply 1st row by $-g$ add to the 5th row $\Rightarrow -i_5 = -g v_{A1}$

$$\begin{bmatrix} 1 & 0 & \vdots & 0 & 0 & 0 \\ 0 & 1 & \vdots & 0 & 0 & 0 \\ \alpha C & -\alpha C & \vdots & -1 & 0 & 0 \\ 0 & -g & \vdots & 0 & -1 & 0 \\ 0 & 0 & \vdots & 0 & 0 & -1 \end{bmatrix} x = \begin{bmatrix} v_{A1} \\ v_{A2} \\ 0 \\ +g v_{A2} \\ -g v_{A1} \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \alpha C & -\alpha C & -1 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} v_{A1} \\ v_{A2} \\ 0 \end{bmatrix}$$

multiply 2nd row by g & add to 4th row

$-i_4 = g v_{A2}$

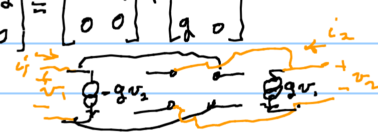
$i_3 = -\alpha C v_{A1} + \alpha C v_{A2}$

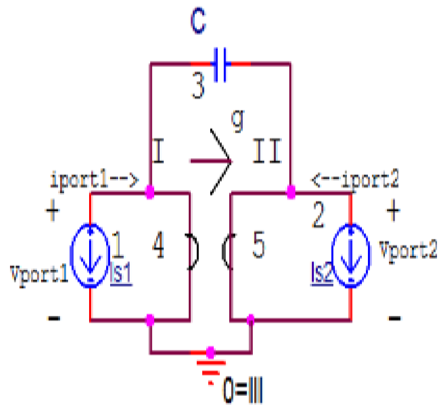
$-i_3 = -\alpha C v_{A1} + \alpha C v_{A2}$, $-i_5' = -g v_{A1}$, $-i_4' = g v_{A2}$

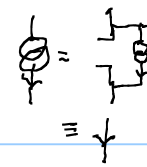
$$i_{10}' = i_3' + i_4' = [+\alpha C v_{A1} \quad (-\alpha C - g) v_{A2}] \Rightarrow -\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} i_{01} \\ i_{02} \end{bmatrix} = \begin{bmatrix} \alpha C & -\alpha C - g \\ -\alpha C + g & \alpha C \end{bmatrix} \begin{bmatrix} v_{A1} \\ v_{A2} \end{bmatrix}$$

$$i_{20}' = -i_3' + i_5' = [-\alpha C v_{A1} + g v_{A1} \quad \alpha C v_{A2}]$$

$$Y_{\substack{2port \\ Richards'}} = \begin{bmatrix} \alpha C & -\alpha C - g \\ -\alpha C + g & \alpha C \end{bmatrix} \qquad Y_{gyr} = \begin{bmatrix} 0 & -g \\ g & 0 \end{bmatrix} = \begin{bmatrix} 0 & -g \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ g & 0 \end{bmatrix}$$







$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & AC & 0 & 0 \\ 0 & 0 & 0 & 0 & -g \\ 0 & 0 & 0 & g & 0 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \\ i_4 \\ i_5 \end{bmatrix}$$

$$\left[Ae^T \;\vdots\; -B\mathcal{J}^T \right] \begin{bmatrix} v_t \\ i_\ell \end{bmatrix} = A v_A - B i_A$$

Here $B = 1_5$ and $i_A = \begin{bmatrix} i_{A_1} \\ i_2 \\ 0 \\ 0 \\ 0 \end{bmatrix}$, $v_{out} = \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = v_t$

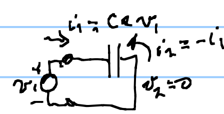
$$\Rightarrow \left[Ae^T \;\vdots\; -\mathcal{J}^T \right] \begin{bmatrix} v_t \\ i_\ell \end{bmatrix} = -\begin{bmatrix} i_{A_1} \\ i_{A_2} \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$e\mathcal{J}^T = 0_{t,\ell} \Rightarrow$ multiply by e $=$ $\underline{eAe^T} v_t = -e \begin{bmatrix} i_{A_1} \\ i_{A_2} \\ 0 \\ 0 \\ 0 \end{bmatrix} = -\begin{bmatrix} i_{A_1} \\ i_{A_2} \end{bmatrix}$

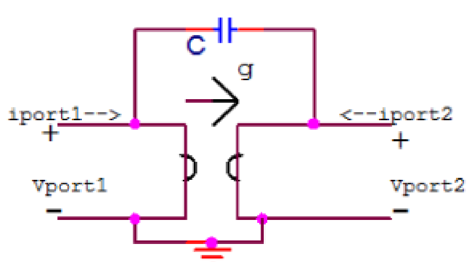
$eAe^T = Y_{2\text{-port}}$

eAe^T

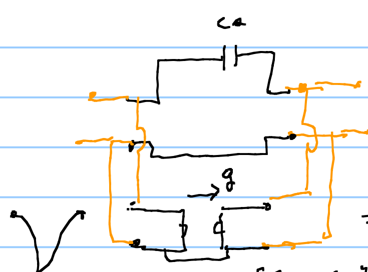
$$\underbrace{\begin{bmatrix} 1 & 0 & \vdots & 1 & 1 & 0 \\ 0 & 1 & \vdots & -1 & 0 & 1 \end{bmatrix}}_{=e} \underbrace{\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ AC & -AC \\ 0 & -g \\ g & 0 \end{bmatrix}}_{= Ae^T} = \begin{bmatrix} AC & -AC-g \\ -AC+g & AC \end{bmatrix} = Y_{2\text{port}}$$



$$y_{11} = \left.\frac{i_1}{v_1}\right|_{v_2=0} = CA, \quad y_{21} = \left.\frac{i_2}{v_1}\right|_{v_2=0} = -CA$$



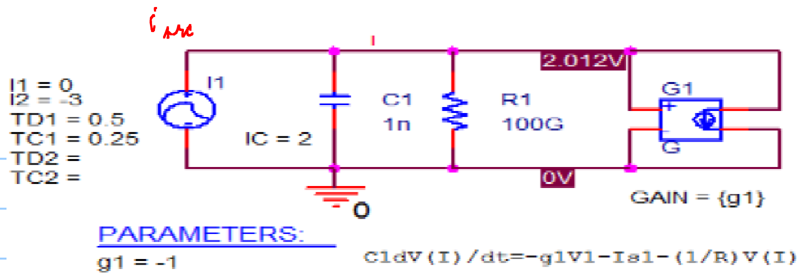
Richards' Section

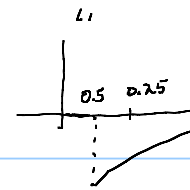


$$Y_c = \begin{bmatrix} CA & -CA \\ -CA & CA \end{bmatrix}$$

$$\Rightarrow Y_g = \begin{bmatrix} 0 & -g \\ g & 0 \end{bmatrix}$$

$$Y = Y_c + Y_g = \begin{bmatrix} CA & -CA \\ -CA & CA \end{bmatrix} + \begin{bmatrix} 0 & -g \\ g & 0 \end{bmatrix} = \begin{bmatrix} CA & -CA-g \\ -CA+g & CA \end{bmatrix}$$





$a\dot{x} + bx = f(t)$, $\dot{} = d/dt = a$ take x as voltage on a capacitor $i_c = C\frac{dv}{dt}$

$C\frac{dv}{dt} = i_c = a\frac{dx}{dt} = -bx + f(t) = -bv + i_s = -Gv + i_s$

$\parallel$

$C = a$