EE610

08/31/17 → 09/01/17

Note Title 8/31/2017

Find preliminary versions of a paper for Tuesday

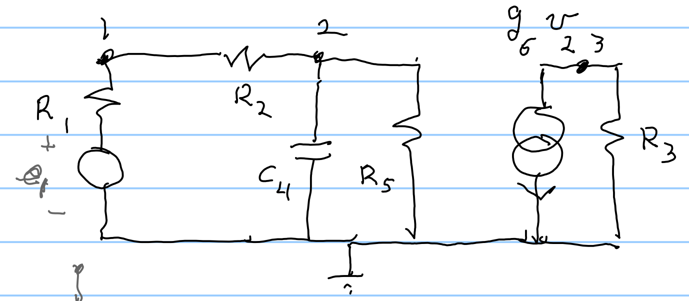
$\mathcal{C} = \begin{bmatrix} 1_t & K \end{bmatrix}$, $\mathcal{J} = \begin{bmatrix} -K^t & 1_\ell \end{bmatrix}$; $0_t = \begin{bmatrix} 1_t & K \end{bmatrix} \begin{bmatrix} i_t \\ \hline i_\ell \end{bmatrix} \Rightarrow i_t = K i_\ell$

$0_\ell = \begin{bmatrix} -K^t , & 1_\ell \end{bmatrix} \begin{bmatrix} v_t \\ v_\ell \end{bmatrix}$ $\quad = \mathcal{C} \cdot i_b$

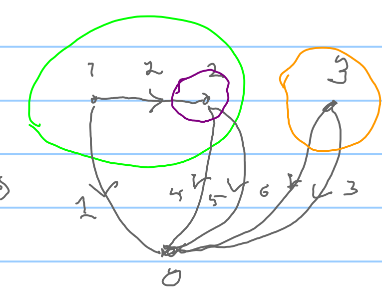
$-K^t v_t = -v_\ell$ $\quad i_t = -K i_\ell = \begin{bmatrix} i_t \\ i_\ell \end{bmatrix} = \begin{bmatrix} i \end{bmatrix}_b = \begin{bmatrix} -K \\ 1_\ell \end{bmatrix} i_\ell = \underbrace{i_b = \mathcal{J}^t \cdot i_\ell}$

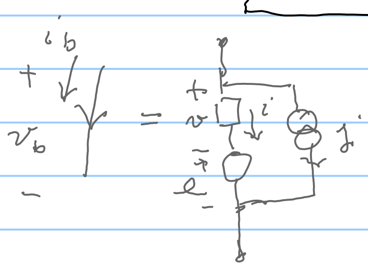
$-v_t = -v_t$ $\quad i_\ell = i_\ell$

$\begin{bmatrix} 1_t \\ K^t \end{bmatrix} v_t = \begin{bmatrix} v_t \\ v_\ell \end{bmatrix} = \underbrace{v_b = \mathcal{C}^t v_t}$



$\Rightarrow$





$i_b = i + j$; $v_b = \mathcal{C}^t v_t$

$v_b = v + e$; $i_b = \mathcal{G}^t i_\ell$

e & j = independent source vectors

$A v = B i$ non independent sources

$A(v_b - e) = B(i_b - j)$

$A\mathcal{C}^t v_t - Ae = B\mathcal{G}^t i_\ell - Bj \Longrightarrow A\mathcal{C}^t v_t - B\mathcal{G}^t i_\ell = Ae - Bj$

$$\begin{bmatrix} A\mathcal{C}^t & -B\mathcal{G}^t \end{bmatrix} \begin{bmatrix} v_t \\ i_\ell \end{bmatrix} = Ae - Bj$$; v_t & i_ℓ unknown

b unknowns & b equations

$$e = \begin{bmatrix} e_1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \quad j = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}; \quad \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \alpha C_4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & g_2 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \\ v_6 \end{bmatrix} = \begin{bmatrix} R_1 & 0 & 0 & 0 & 0 & 0 \\ 0 & R_2 & 0 & 0 & 0 & 0 \\ 0 & 0 & R_3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & R_5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \\ i_4 \\ i_5 \\ i_6 \end{bmatrix}$$

$$A v = B i$$

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = \left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & -1 & -1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{array}\right] i_b = C i_b, \qquad \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = \left[\begin{array}{ccc|ccc} -1 & +1 & 0 & 1 & 0 & 0 \\ -1 & +1 & 0 & 0 & 1 & 0 \\ 0 & 0 & -1 & 0 & 0 & 1 \end{array}\right] v_b$$

$$\left[\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \alpha C_4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & g_2 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ \hline 1 & -1 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \;\vdots\; - \begin{bmatrix} R_1 & 0 & 0 & 0 & 0 & 0 \\ 0 & R_2 & 0 & 0 & 0 & 0 \\ 0 & 0 & R_3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & R_5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -1 & -1 & 0 \\ +1 & 1 & 0 \\ 0 & 0 & -1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}\right] \begin{bmatrix} v_{1b} \\ v_{2b} \\ v_{3b} \\ i_{4b} \\ i_{5b} \\ i_{6b} \end{bmatrix} = \begin{bmatrix} e_1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

6 equations & 6 unknowns, $b = 6$, $t = 3 = l$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & -R_1 & -R_1 & 0 \\ 0 & 1 & 0 & R_2 & R_2 & 0 \\ 0 & 0 & 1 & 0 & 0 & -R_3 \\ sC_4 & -sC_4 & 0 & 1 & 0 & 0 \\ 1 & -1 & 0 & 0 & R_5 & 0 \\ 0 & g_2 & 0 & 0 & 0 & 1 \end{array}\right] \begin{bmatrix} v_t \\ \hline i_\ell \end{bmatrix} = \begin{bmatrix} e_1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \Rightarrow$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ sC_4 & -sC_4 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} x = \begin{bmatrix} -1 & 0 & 0 & +R_1 & R_1 & 0 \\ 0 & -1 & 0 & -R_2 & -R_2 & 0 \\ 0 & 0 & -1 & 0 & 0 & R_3 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ -1 & 1 & 0 & 0 & -R_5 & 0 \\ 0 & -g_2 & 0 & 0 & 0 & -1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} e_1$$

$$= \underbrace{\begin{aligned} E\dot{x} &= \mathcal{A}x + \mathcal{B}u, \\ y &= C_x x \end{aligned}}_{\text{semi-state eqs.}} \qquad u = \text{input}, \quad x = \begin{bmatrix} v_t \\ i_\ell \end{bmatrix}, \quad y = \text{output}$$

semi-state eqs. $\Rightarrow$ differential-algebraic eqs.

singular differential eqs.