EE 610
09/06/16

Note Title 9/5/2016

$Av = Bi$ $Y = B^{-1}A$ = admittance

$CAv = CBi$ $i = Yv \Rightarrow C = B^{-1} \Rightarrow i = B^{-1}Bi = B^{-1}Av$

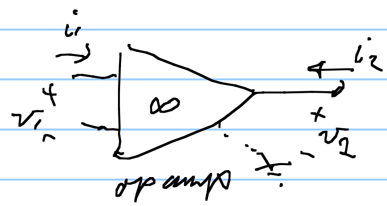
$v = Zi \Rightarrow Z = A^{-1}B$

op amp: $v_1 = 0$, $i_1 = 0$

v_2 = arb, i_2 = arb independent of v_2

$$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} \; ; \; A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} ; \; \det = 0 \text{ no } A^{-1}$$

$$B = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix} ; \; \det = 0 \text{ no } B^{-1}$$

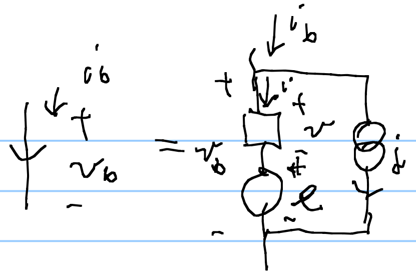


has no Z or Y

laws of connection, KCL, KVL; $v_b = \mathcal{E}^T v_t$, $i_b = \mathcal{J}^T i_\ell$, $0 = \mathcal{E} i_b$, $0 = \mathcal{J} v_b$

laws of devices (linear $Av = Bi$), v & i sources

$\Downarrow e$ $\Downarrow j$



$i_b = i + j \Rightarrow i = i_b - j$

$v_b = v + e \qquad v = v_b - e$

$Av = Bi \Rightarrow Av_b - Ae = Bi_b - Bj$

$$Av_b - Bi_b = \underbrace{Ae - Bj}_{\text{sources}} \qquad b = t + l$$

$$\underbrace{A\mathcal{C}^T}_{b \times t}\underbrace{v_t}_{t} - \underbrace{B\mathcal{J}^T}_{b \times l}\underbrace{i_l}_{l} = Ae - Bj \Rightarrow$$

$$\begin{bmatrix} A\mathcal{C}^T & -B\mathcal{J}^T \end{bmatrix} \begin{bmatrix} v_t \\ i_l \end{bmatrix}$$

also Spice use for ordinary differential equations
$C \to$ derivatives via $i = C\,dv/dt$ & G = VCCS to give capacitor currents via their voltages. Gvalue allows functions & PARAM allows changing values of components.