① Ans.

$$L = \begin{bmatrix} 5 & & \\ 0 & 3 & \\ 20 & 9 & -6 \end{bmatrix} \qquad U = \begin{bmatrix} 1 & \frac{2}{5} & 0 \\ & 1 & \frac{2}{3} \\ & & 1 \end{bmatrix}$$

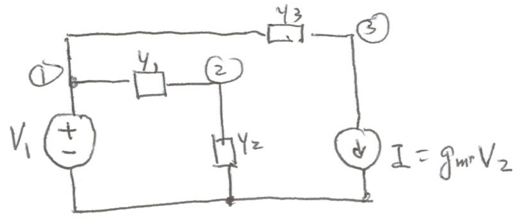
解 $Lz = b$

$$\begin{bmatrix} 5 & & \\ 0 & 3 & \\ 20 & 9 & -6 \end{bmatrix} \begin{bmatrix} z_1 \\ z_2 \\ z_3 \end{bmatrix} = \begin{bmatrix} 14 \\ 1 \\ 9 \end{bmatrix} \Rightarrow z_1 = \frac{14}{5}, \quad z_2 = \frac{1}{3}, \quad z_3 = 5.$$

解 $Ux = z$

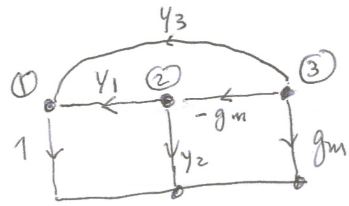
$$\begin{bmatrix} 1 & \frac{2}{5} & 0 \\ & 1 & \frac{2}{3} \\ & & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{14}{5} \\ \frac{1}{3} \\ 5 \end{bmatrix} \Rightarrow x_1 = 4, \quad x_2 = -3, \quad x_3 = 5$$

②

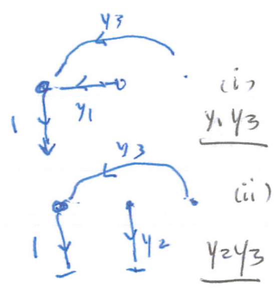


Solve for V_3/V_1 using directed graph.

Ans.



Tree search

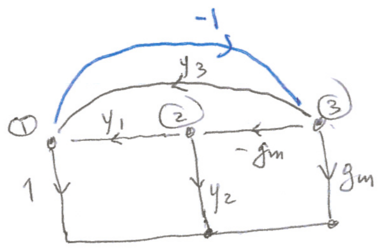


$$分母 = \Delta_{11} = \delta_{11} = (1)\begin{pmatrix} y_1 \\ & y_2 \end{pmatrix}\begin{pmatrix} -g_m \\ g_m \\ y_3 \end{pmatrix}$$

$$= y_1(-g_m + g_m) + \underbrace{y_1 y_3}_{(i)} + y_2(-g_m + g_m) + \underbrace{y_2 y_3}_{(ii)}$$

$$\boxed{\Delta_{11} = y_1 y_3 + y_2 y_3}$$

$$分子 = \Delta_{13} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}\begin{pmatrix} y_1 \\ y_2 \end{pmatrix}\begin{pmatrix} -g_m \\ g_m \\ y_3 \end{pmatrix}$$



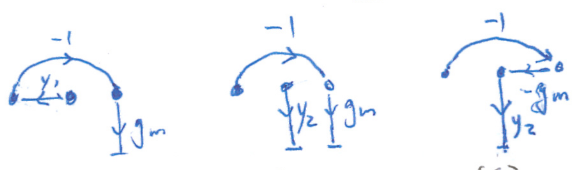
$$\delta_{11} = y_1 y_3 + y_2 y_3$$

$$-\delta_{13} = (-1) = \overset{(a)}{-y_1 g_m} \overset{(b)}{\cancel{- y_2 g_m}} \overset{(c)}{\cancel{- y_2(-g_m)}}$$

$$= -y_1 g_m$$

$$\therefore \Delta_{13} = \delta_{11} - \delta_{13} = y_1 y_3 + y_2 y_3 - y_1 g_m$$

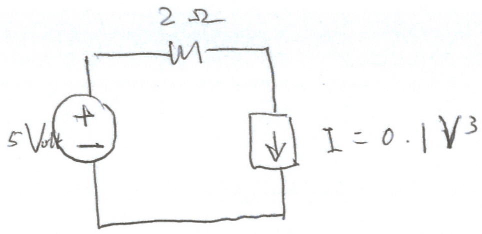
Tree-search



(a) (b) (c)

$$\frac{V_3}{V_1} = \frac{\Delta_{13}}{\Delta_{11}} = \frac{y_1 y_3 + y_2 y_3 - y_1 g_m}{y_1 y_3 + y_2 y_3}$$

3.



<u>Ans.</u> $I = 0.1V^3 \Rightarrow V^3 = 10I$

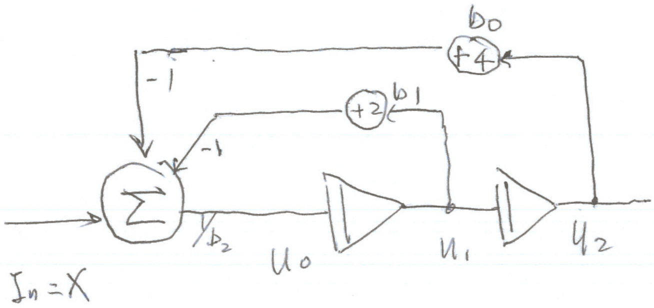
Given the estimate of V equal to 2 volt $\Rightarrow V^m = 2$

$$g^m = \frac{dI}{dV} = 0.3V^2 = 0.3(V^m)^2 = 1.2.$$

$$i^m = 0.1(V^m)^3 = 0.8.$$

$$V^{m+1} = \frac{V_s - R(i^m - g^m V^m)}{1 + R \cdot g^m} = \frac{5 - 2(0.8 - 1.2 \times 2)}{1 + 2 \times 1.2} = \frac{8.2}{3.4} = \underline{2.4117}$$

4.



<u>Ans.</u> 已知 $u_{1,m} = 1$, $u_{2,m} = 0.5$, $I_n = X_{m+1} = 3$, $T = 1$. 求 $u_{2,m+1}$. (m 為 time-step)

$u_{1,m} = 1 = T \cdot u_{0,m} \Rightarrow u_{0,m} = 1$. Initial: $1/b_n = u_0 \Rightarrow b_n = 1 = b_2$

$$u_{0,m+1} = \frac{I_n - \sum_{k=1}^{2}\left\{ b_{2-k}\left[u_{k,m} + \sum_{j=1}^{k-1} (T)^j \cdot u_{k-1,m} \right]\right\}}{\sum_{k=0}^{2} (T)^k \cdot b_{2-k}}$$

($n=2$ 代入公式. Eq. (6)
$u_{k,\underline{n}}$ 中之 n 換成 m)

$$= \frac{I_n - \overbrace{b_1 u_{1,m}}^{k=1} - \overbrace{b_0 u_{2,m} - b_0 T \cdot u_{1,m}}^{k=2}}{\underbrace{b_2}_{k=0} + \underbrace{b_1 T}_{k=1} + \underbrace{b_0 T^2}_{k=2}} = \frac{3 - 2\times1 - 4\times0.5 - 4\times1\times1}{1 + 2 + 4} = \frac{-7}{4p}$$

$$= \underline{-0.71428}$$

$$u_{1,m+1} = u_{1,m} + T \cdot u_{0,m+1} = 1 - \frac{5}{7} = \frac{2}{7} = 0.2857$$

$$u_{2,m+1} = u_{2,m} + T \cdot u_{1,m+1} = 0.5 + \frac{2}{7} = \frac{5.5}{7} = \underline{0.7857}$$