HA #2

Date

(5) From the impedance matrix:

$$V_1 = 2I_1 + I_2 + 2I_3$$

$$V_2 = I_1 + I_2 + 4I_3$$

$$V_3 = 2I_1 + 4I_2 + I_3$$

The source at port-1 is described by:

$$V_1 = 16.0 - (1)I_1$$

The short circuit on port-2 means:

$$V_2 = 0$$

The load on port-3 leads to:

$$V_3 = -(1)I_3$$

Solve the above equations to find:

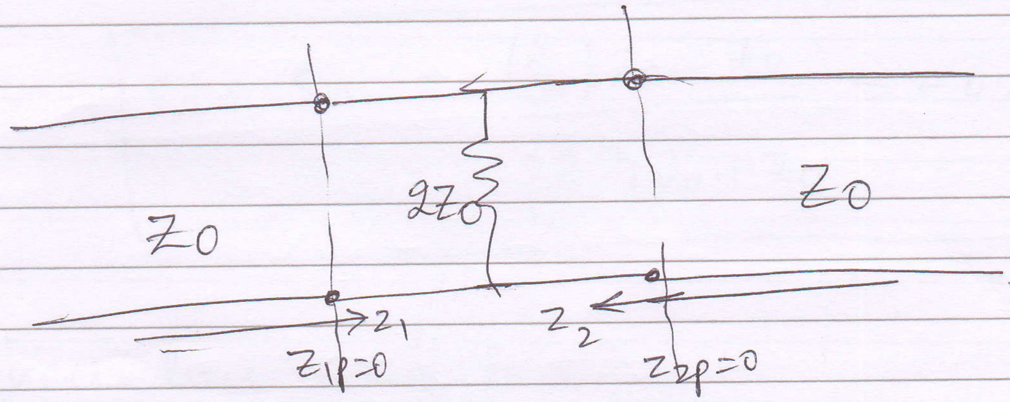
$I_1 = 7.0$ $\quad$ $I_2 = -3.0$ $\quad$ $I_3 = -1.0$

$V_1 = 9.0$ $\quad$ $V_2 = 0.0$ $\quad$ $V_3 = 1.0$

HA #2

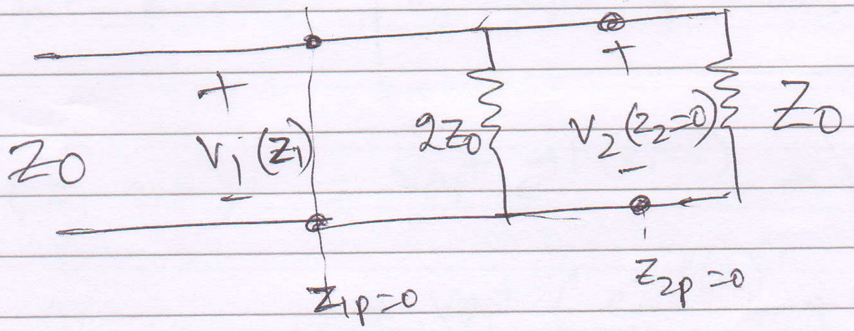
Date ____________

(6)



Step-1

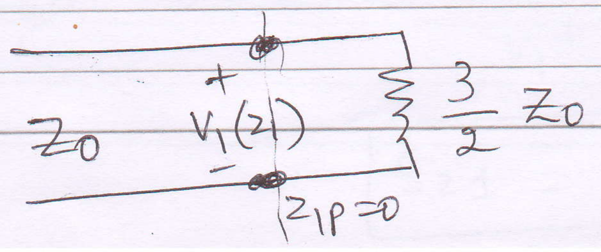
terminate port-2 into matched load:



Port-2 is matched: $V_2^+(z_2=z_{2p})=0$

thus: $$V_2(z_2=0) = V_2^+(z_2=0)+V_2^-(z_2=0)$$
$$= 0 + V_2^-(z_2=0)$$
$$= V_2^-(z_2=0)$$

Simplify the above ckt as:



Date

Therefore we infer from the above ckt:

$$\boxed{\Gamma_0 = S_{11} = \frac{\left(\frac{2}{3}\right)Z_0 - Z_0}{\left(\frac{2}{3}\right)Z_0 + Z_0} = -0.2}$$

From boundary condition:

$$V_2(z_2=0) = V_1(z_1=0)$$

we know, $\boxed{V_2(z_2=0) = V_2^-(z_2=0)}$

$$V_1(z_1=0) = V_{01}^+ e^{-j\beta(z_1=0)} + V_{01}^- e^{+j\beta(z_1=0)}$$

$$= V_{01}^+ \left(e^{-j\beta(0)} + \Gamma_0 e^{+j\beta(0)}\right)$$

$$= V_{01}^+ (1 - 0.2)$$

$$\boxed{\therefore V_1(z_1=0) = 0.8\, V_{01}^+}$$

Therefore : $V_2(z_2=0) = V_1(z_1=0) = 0.8 V_{01}^+$

Also, we have:

$$V_2(z_2=0) = V_2^-(z_2=0)$$

$$\Rightarrow S_{21} = \frac{V_2^-(z_2=0)}{V_1^+(z_1=0)} = \frac{0.8\, V_{01}^+}{V_{01}^+}$$

$$\therefore \boxed{S_{21} = 0.8}$$

Date

Symmetry gives:

$$S_{11} = S_{22} = -0.2$$

$$S_{21} = S_{12} = 0.8$$

Therefore:

$$\boxed{S = \begin{bmatrix} -0.2 & 0.8 \\ 0.8 & -0.2 \end{bmatrix}}$$