$z_{11} = 3\,\Omega$
$z_{12} = 5\,\Omega$
$z_{21} = 6\,\Omega$
$z_{22} = 10\,\Omega$
$z_L = 10\,\Omega$ find I_L for $V_1 = 30V$

z-parameter option ①

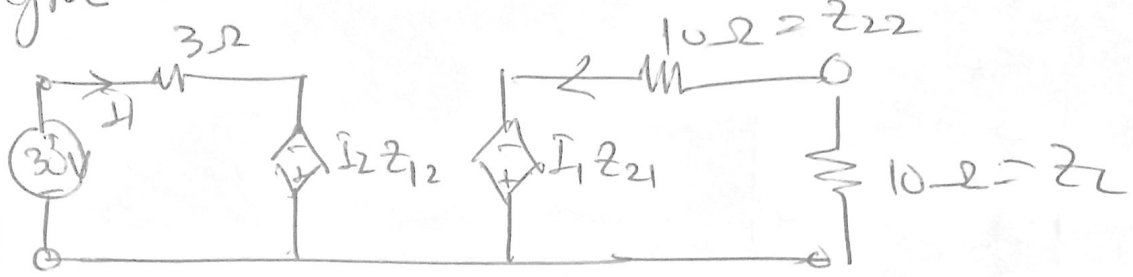
Solution

Equations

$$V_1 = I_1 z_{11} + I_2 z_{12} \quad \text{——— (1)}$$

$$V_2 = I_1 z_{21} + I_2 z_{22} \quad \text{——— (2)}$$

Diagram



new equations

① ⇒ $30V = I_1(3) + I_2(5)$

$0 = I_1(6) + I_2(10 + 10)$ (z_{22}, z_L)

Solve for I_1 and I_2

$I_L = I_2$ = answer.

Note: we can clearly see that once we find the [Z] matrix we easily add z_{22} and z_L to solve the problem.

The same method will add Y_{22} with Y_L is parallel

Y-parameters given

$Y_{11} = 0.5$

$Y_{12} = 0.2$

$Y_{21} = 1$

$Y_{22} = 0.\overline{33}$

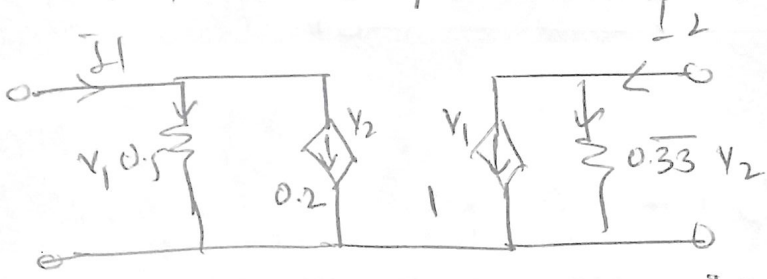
If a Load $Y_L = 0.2\mho$ is connected at output find I_L (out current) ? for $V_1 = 5$ Volts

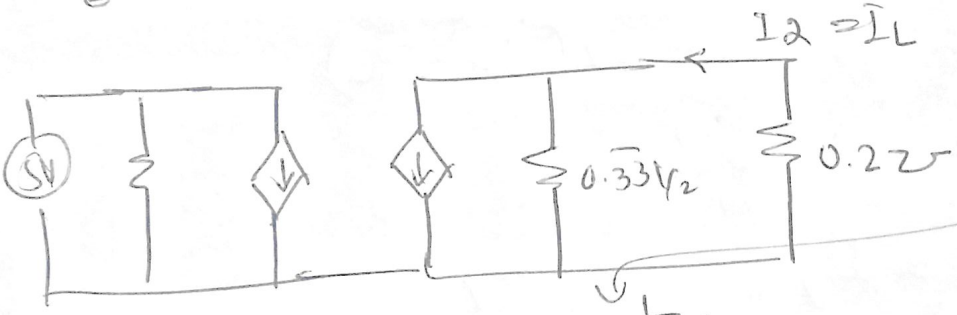
$$I_1 = V_1 Y_{11} + V_2 Y_{12} \quad \text{——— (1)}$$

$$I_2 = V_1 Y_{21} + V_2 Y_{22} \quad \text{——— (2)}$$

$$Y_L = \frac{1}{Z_L} = 5\mho$$

$$[Y] = \begin{bmatrix} 0.5 & 0.2 \\ 1 & 0.\overline{33} \end{bmatrix}$$





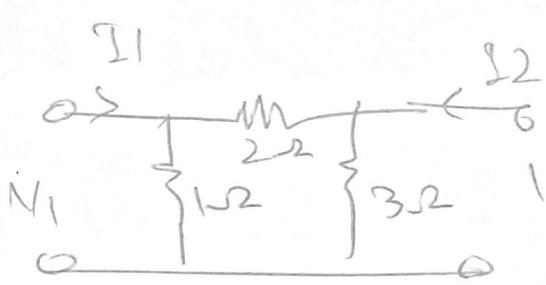
$$V_2 = \frac{1}{Y_L} * I_L$$

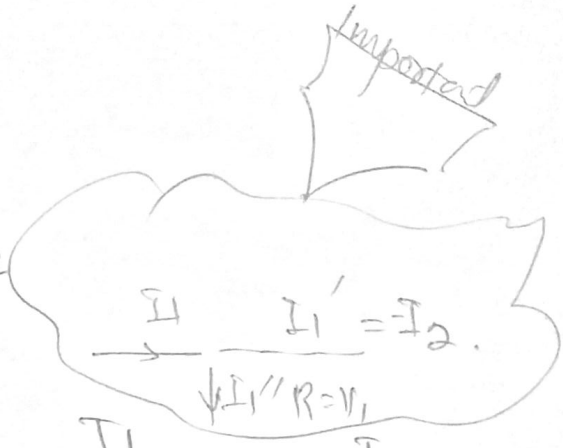
① $\Rightarrow$ $I_1 = 5(0.5) + \left(I_2 * \frac{1}{0.2}\right)(0.2)$

② $\Rightarrow$ $I_2 = 5(1) + \left(I_2 * \frac{1}{0.2}\right)(0.2 + 0.33)$

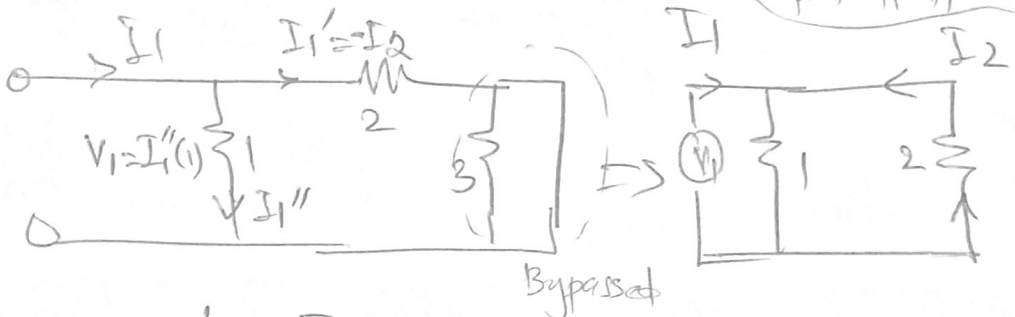
Solve for I_1 and I_2

Example 16.1





$V_2 = 0$



Finding Current in each Branch

$$I_1' = -I_2$$

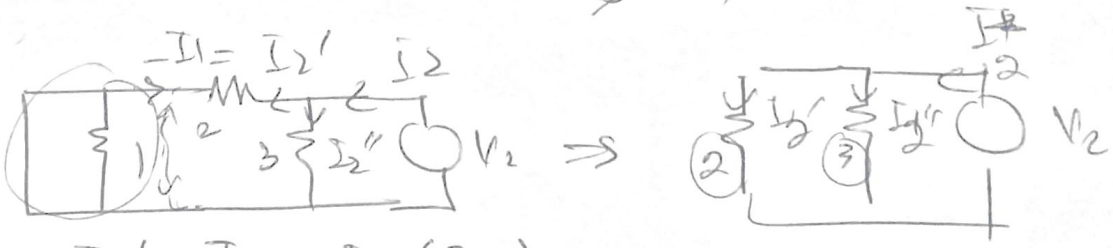
$$I_1' = I_1\left(\frac{1}{3}\right) \qquad I_1'' = I_1\left(\frac{2}{3}\right)$$

$$-I_2 = \frac{I_1}{3}$$

$$Y_{11} = \frac{I_1}{V_1} = \frac{I_1}{I_1''(1\Omega)} = \frac{I_1}{I_1\left(\frac{2}{5}\right)1} = \frac{3}{2}\ S$$

$$Y_{21} = \frac{I_2}{V_1} = \frac{-I_1'}{I_1''(1\Omega)} = \frac{\frac{-I_1}{3}}{\frac{2}{3}(1)} = -\frac{1}{2}\ S.$$

$V_1 = 0$



Finding Current in each Branch

$$I_2' = -I_1 = I_2\left(\frac{3}{5}\right)$$

$$I_2'' = I_2\left(\frac{2}{5}\right)$$

$$Y_{12} = \frac{I_1}{V_2} = \frac{-I_2\left(\frac{3}{5}\right)}{I_2''(3)} = \frac{-I_2/5}{I_2\left(\frac{2}{5}\right)} = -\frac{1}{2}\ S.$$

$$Y_{22} = \frac{I_2}{V_2} = \frac{I_2}{I_2''(3)} = \frac{I_2}{I_2\left(\frac{2}{5}\right)(3)} = \frac{1}{6/5} = \frac{5}{6}\ S$$