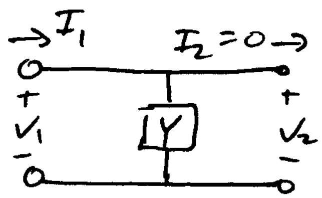
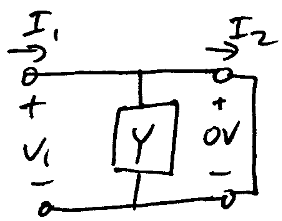
4.21 The *ABCD* parameters of the first entry in Table 4.1 were derived in Example 4.6. Verify the *ABCD* parameters for the second, third, and fourth entries.



Use equations per text pp 190-191

$$A = \left.\frac{V_1}{V_2}\right|_{I_2=0} = \underline{1} \quad \text{(directly in parallel)} \quad V_1 = V_2$$

$$C = \left.\frac{I_1}{V_2}\right|_{I_2=0} = \frac{V_2 Y}{V_2} = \underline{Y} \quad \text{(Ohm's Law)}$$



By current division, $I_2 = I_1$

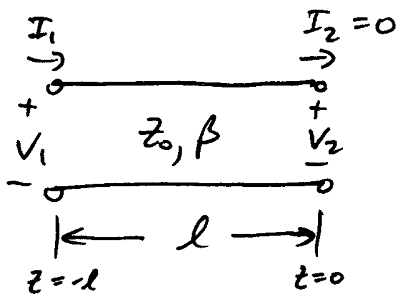
By inspection, $V_1 = V_2 = 0$

$$B = \left.\frac{V_1}{I_2}\right|_{V_2=0} = \frac{0}{I_2} = \underline{0}$$

$$D = \left.\frac{I_1}{I_2}\right|_{V_2=0} = \frac{I_2}{I_2} = \underline{1}$$

$$\boxed{\begin{bmatrix} A & B \\ C & D \end{bmatrix}_Y = \begin{bmatrix} 1 & 0 \\ Y & 1 \end{bmatrix}}$$

Same as Table 4.1



$\Rightarrow$ Open circuit stub situation ($\Gamma = 1$)

Per (2.36a), $V(z) = V_0^+\left[e^{-j\beta z} + \Gamma e^{j\beta z}\right]$

$$V_2 = V(0) = V_0^+\left[1 + \Gamma(1)\right] = 2V_0^+$$

$$V_1 = V(-\ell) = V_0^+\left[e^{j\beta\ell} + (1)e^{-j\beta\ell}\right] = V_0^+ 2\cos\beta\ell$$

Trig ID

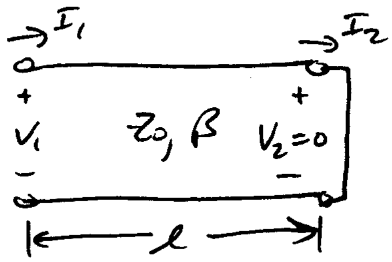
$$A = \left.\frac{V_1}{V_2}\right|_{I_2=0} = \frac{V_0^+ 2\cos\beta\ell}{2V_0^+} = \underline{\cos\beta\ell}$$

Per (2.36b), $I(z) = \frac{V_0^+}{Z_0}\left[e^{-j\beta z} - \Gamma e^{j\beta z}\right]$

$$I_1 = I(-\ell) = \frac{V_0^+}{Z_0}\left[e^{+j\beta\ell} - (1)e^{-j\beta\ell}\right] = \frac{V_0^+}{Z_0} j2\sin\beta\ell$$

Trig ID

$$C = \left.\frac{I_1}{V_2}\right|_{I_2=0} = \frac{\frac{V_0^+}{Z_0} j2\sin\beta\ell}{V_0^+ 2} = \frac{j\sin\beta\ell}{Z_0} = \underline{jY_0\sin\beta\ell}$$



$\Rightarrow$ Short circuit stub situation ($\Gamma = -1$)

$$V_1 = V(-\ell) = V_0^+\left[e^{j\beta\ell} + (-1)e^{-j\beta\ell}\right] = V_0^+ j2\sin\beta\ell$$

$$I_2 = I(0) = \frac{V_0^+}{Z_0}\left[1 - (-1)1\right] = \frac{2V_0^+}{Z_0}$$

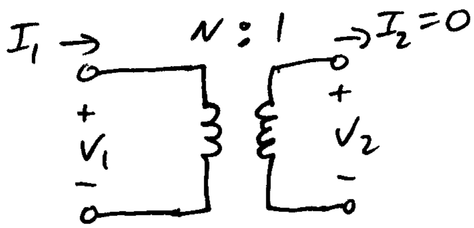
$$B = \left.\frac{V_1}{I_2}\right|_{V_2=0} = \frac{V_0^+ j2\sin\beta\ell}{2V_0^+/Z_0} = \underline{jZ_0\sin\beta\ell}$$

$$I_1 = I(-\ell) = \frac{V_0^+}{Z_0}\left[e^{j\beta\ell} - (-1)e^{-j\beta\ell}\right] = \frac{V_0^+}{Z_0}2\cos\beta\ell$$

$$D = \left.\frac{I_1}{I_2}\right|_{V_2=0} = \frac{\frac{V_0^+}{Z_0}2\cos\beta\ell}{2V_0^+/Z_0} = \underline{\cos\beta\ell}$$

$$\boxed{\begin{bmatrix} A & B \\ C & D \end{bmatrix}_{TL} = \begin{bmatrix} \cos\beta\ell & jZ_0\sin\beta\ell \\ jY_0\sin\beta\ell & \cos\beta\ell \end{bmatrix}}$$

$\therefore$ Same as Table 4.1



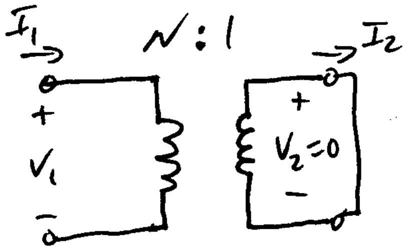
From circuits text:

$$V_1 = NV_2$$

$$I_1 = I_2/N = 0$$

$$A = \left.\frac{V_1}{V_2}\right|_{I_2=0} = \frac{NV_2}{V_2} = \underline{N}$$

$$C = \left.\frac{I_1}{V_2}\right|_{I_2=0} = \frac{0}{V_2} = \underline{0}$$



From circuits text:

$$V_1 = NV_2 = N(0) = 0$$

$$I_1 = I_2/N$$

$$B = \left.\frac{V_1}{I_2}\right|_{V_2=0} = \frac{0}{I_2} = \underline{0}$$

$$D = \left.\frac{I_1}{I_2}\right|_{V_2=0} = \frac{I_2/N}{I_2} = \underline{\frac{1}{N}}$$

$$\boxed{\begin{bmatrix} A & B \\ C & D \end{bmatrix}_{xfmr} = \begin{bmatrix} N & 0 \\ 0 & \frac{1}{N} \end{bmatrix}}$$

$\therefore$ Same as Table 4.1