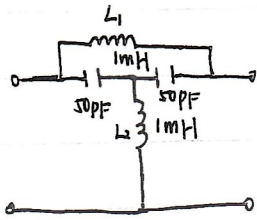


Xuefei Meng



$$f = 1 \text{ MHz}$$

10/10

$$Y_{11} = Y_{22} = \frac{1}{sL_1} + \left[\frac{1}{sC} + (sL_2 // \frac{1}{sC}) \right]^{-1} = \frac{1}{sL_1} + \left[\frac{1}{sC} + \frac{sL_2}{s^2L_2C + 1} \right]^{-1}$$

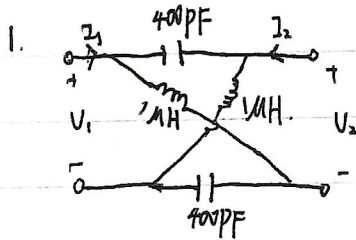
$$sL_1 = sL_2 = j2\pi \cdot 10^6 \times 10^{-3} \sim j6.28 \times 10^3 \Omega$$

$$sC = j \cdot 2\pi \times 50 \times 10^{-6} \sim j3.14 \times 10^{-4} \Omega$$

$$Y_{12} = Y_{21} = -\frac{1}{sL_1} - \frac{s^3L_2C^2}{2s^2L_2C + 1}$$

$$Y = \begin{bmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{bmatrix} = \begin{bmatrix} \frac{1}{sL_1} + \left[\frac{1}{sC} + \frac{sL_2}{s^2L_2C + 1} \right]^{-1} & -\frac{1}{sL_1} - \frac{s^3L_2C^2}{2s^2L_2C + 1} \\ -\frac{1}{sL_1} - \frac{s^3L_2C^2}{2s^2L_2C + 1} & \frac{1}{sL_1} + \left[\frac{1}{sC} + \frac{sL_2}{s^2L_2C + 1} \right]^{-1} \end{bmatrix}$$

$$= -j \cdot 10^5 \begin{bmatrix} 5.53 & 5.12 \\ 5.12 & 5.53 \end{bmatrix}$$



$$Z_{11} = \frac{U_1}{I_1} \Big|_{I_2=0} = \frac{1}{2} \left[\frac{1}{sC} + sL \right]$$

$$Z_{12} = \frac{U_1}{I_2} \Big|_{I_1=0} = \frac{1}{2} \left[sL - \frac{1}{sC} \right]$$

$$Z_{21} = \frac{U_2}{I_1} \Big|_{I_2=0} = \frac{1}{2} \left[sL - \frac{1}{sC} \right]$$

$$Z_{22} = \frac{U_2}{I_2} \Big|_{I_1=0} = \frac{1}{2} \left[\frac{1}{sC} + sL \right]$$

$$Z = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix} = \frac{1}{2} \begin{bmatrix} \frac{1}{sC} + sL & sL - \frac{1}{sC} \\ sL - \frac{1}{sC} & \frac{1}{sC} + sL \end{bmatrix} = \frac{1}{2sC} \begin{bmatrix} s^2LC + 1 & s^2LC - 1 \\ s^2LC - 1 & s^2LC + 1 \end{bmatrix}$$

$$s^2LC = (j5 \times 10^7)^2 \times 4 \times 10^{-10} \times 1 \times 10^{-3} = -1$$

$$sC = (j5 \times 10^7) \times 4 \times 10^{-10} = j2 \times 10^{-2} = j/50$$

$$Z = -j^{25} \begin{bmatrix} 0 & -2 \\ -2 & 0 \end{bmatrix}$$