

数学作业纸

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班级: 180231 姓名: 钱思远 编号: 18373038 科目: 微波 m00c

2-15

解: $\Gamma_2 = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{1}{3}$

$$\Gamma(z) = |\Gamma_2| e^{j(\phi_2 - 2\beta z)} = \frac{1}{3} e^{j2\beta z}$$

$$Z_{in} = Z_0 \frac{1 + \Gamma}{1 - \Gamma}$$

① $z = 0.2\lambda$

$$\Gamma(0.2\lambda) = \frac{1}{3} e^{-j2 \cdot \frac{2\pi}{\lambda} \cdot 0.2\lambda} = \frac{1}{3} e^{-j0.8\pi}$$

$$Z_{in}(0.2\lambda) = 50 \frac{1 + \frac{1}{3} e^{-j0.8\pi}}{1 - \frac{1}{3} e^{-j0.8\pi}}$$

② $z = 0.25\lambda$

$$\Gamma(0.25\lambda) = \frac{1}{3} e^{j2 \cdot \frac{2\pi}{\lambda} \cdot 0.25\lambda} = -\frac{1}{3}$$

$$Z_{in}(0.25\lambda) = 50 \frac{1 - \frac{1}{3}}{1 + \frac{1}{3}} = 25 \Omega$$

③ $z = 0.5\lambda$

$$\Gamma(0.5\lambda) = \frac{1}{3}$$

$$Z_{in}(0.5\lambda) = 50 \Omega$$

2-16

解: $\rho = \frac{1 + |\Gamma|}{1 - |\Gamma|}$

$$\Gamma_2 = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{-25 + j100}{175 + j100} = 0.51 \angle 74.3^\circ \Omega$$

$$|\Gamma| = 0.51$$

$$\rho = 3.09$$

② $\Gamma(z) = \Gamma_2 \cdot e^{-j2\beta z}$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{3 \times 10^9} = 0.1 \text{ m}$$

$$0.10 \text{ cm} = \lambda$$

由半波重复性: $\Gamma(10 \text{ cm}) = \Gamma_2 = 0.51 \angle 74.3^\circ \Omega$

③ $2.5 \text{ cm} = \frac{\lambda}{4}$

由 $\frac{\lambda}{4}$ 变换性:

$$Z_{in}(\frac{\lambda}{4}) = \frac{Z_0^2}{Z_L} = 48 - j64 \Omega$$



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2-17.

$$\textcircled{1} \text{解: } \rho = \frac{|U|_{\max}}{|U|_{\min}} = 2$$

$$k = \frac{1}{\rho} = \frac{1}{2}$$

$$\textcircled{2} \text{解: } |\Gamma| = \frac{\rho-1}{\rho+1} = \frac{1}{3}$$

$$\Gamma(z) = |\Gamma| e^{j(\phi_2 - 2\beta z)}$$

$$\Gamma(z) = \frac{1}{3} e^{j\phi_2 - 2\beta z}$$

$$\phi_2 - 2\beta z = 0 \pm 2n\pi$$

$$\phi_2 = 2 \cdot \frac{2\pi}{\lambda} \cdot 0.05\lambda = 0.2\pi$$

$$\therefore \Gamma_2 = \frac{1}{3} e^{j0.2\pi}$$

$$\textcircled{3} \text{解: } Z_L = Z_0 \frac{1+\Gamma_L}{1-\Gamma_L} = 300 \frac{1+\frac{1}{3}e^{j0.2\pi}}{1-\frac{1}{3}e^{j0.2\pi}}$$

$$\textcircled{4} \text{解: } Z_{in}(z) = Z_0 \frac{1+\Gamma(z)}{1-\Gamma(z)}$$

$$\text{波腹: } Z_{in}(z) = \frac{Z_0 \rho}{\rho} = 600 \Omega$$

$$\text{波节: } Z_{in}(z) = \frac{Z_0}{\rho} = 150 \Omega$$

2-23.

AB

CD

DE: 驻波.

$$Z_E = \infty, \quad Z_D = Z_{in}(DE) // Z_2 = 225 \Omega$$

CD: 行驻波.

$$Z_P = 225 \Omega, \quad Z_{in}(CD) = \frac{Z_1^2}{Z_P} = 100 \Omega$$

BC: 行波.

$$Z_C = Z_{in}(CD) = 100 \Omega$$

$$\left(\frac{1}{2}\right) Z_{in}(BC) = Z_C = 100 \Omega$$

$$BF: \text{行波}, \quad Z_{in}(BF) = \frac{Z_0^2}{Z_1} = 100 \Omega$$

$$BG: \text{驻波}, \quad Z_{in}(BG) = \infty$$

AB: 行驻波.

$$Z_B = Z_{in}(BF) // Z_{in}(BG) // \infty = 50 \Omega < 100 \Omega$$

$$\left(\frac{1}{4}\right) Z_A = \frac{Z_0^2}{Z_B} = 200 \Omega$$

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AB 段:

$$|U_A| = E_g \cdot \frac{Z_A}{Z_A + Z_g} = 33.4 \text{ mV}$$

$$|I_A| = \frac{|U_A|}{Z_A} = 0.167 \text{ mA}$$

$$\Gamma_B = \frac{Z_B - Z_0}{Z_B + Z_0} = -\frac{1}{3}, \quad P_{AB} = \frac{1 + \frac{1}{3}}{1 - \frac{1}{3}} = 2$$

B 处为电压波节点.

$$|U_B| = \frac{|U_A|}{P_{AB}} = 16.7 \text{ mV}$$

$$|I_B| = |I_A| \cdot P_{AB} = 0.33 \text{ mA}$$



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BG 段: (驻波)

$$|\dot{U}_B| = 16.7 \text{ mV}$$

$$\Gamma_G = -1, \quad P_{BG} = \infty$$

$$|\dot{I}_{BG}| = \frac{|\dot{U}_B|}{Z_{in}(BG)} = 0$$

$$|\dot{U}_B(BG)| = (1 + |\Gamma_G|) |\dot{U}_i(BG)|$$

$$|\dot{U}_i(BG)| = 8.35 \text{ mV}$$

$$|\dot{I}_i(BG)| = \frac{|\dot{U}_i(BG)|}{Z_0} = 0.0835 \text{ mA}$$

G 处: 电压波节点.

$$|\dot{U}_G| = 0, \quad |\dot{I}_G| = (1 + |\Gamma_G|) |\dot{I}_i(BG)| = 0.167 \text{ mA}$$

BF 段: 行波.

$$|\dot{U}_B(BF)| = |\dot{U}_i(BF)| = |\dot{U}_B| = 16.7 \text{ mV}$$

$$|\dot{I}_B(BF)| = |\dot{I}_i(BF)| = \frac{|\dot{U}_i(BF)|}{Z_0} = 0.167 \text{ mA}$$

BC 段: 行波.

$$|\dot{U}_B(BC)| = |\dot{U}_i(BC)| = |\dot{U}_B| = 16.7 \text{ mV}$$

$$|\dot{I}_B(BC)| = |\dot{I}_i(BC)| = \frac{|\dot{U}_i(BC)|}{Z_0} = 0.167 \text{ mA}$$

CD 段: 行驻波.

$$\Gamma_D = \frac{Z_D - Z_0}{Z_D + Z_0} = 0.2, \quad P_{CD} = 1.5$$

CD 始段 电压波节点.

$$|\dot{U}_C(CD)| = 16.7 \text{ mV}, \quad |\dot{I}_C(CD)| = \frac{|\dot{U}_C(CD)|}{Z_{in}(CD)} = 0.167 \text{ mA}$$

终端 电压波腹.

$$|\dot{U}_D| = 25 \text{ mV}, \quad |\dot{I}_D| = 0.111 \text{ mA}$$

DE: 驻波

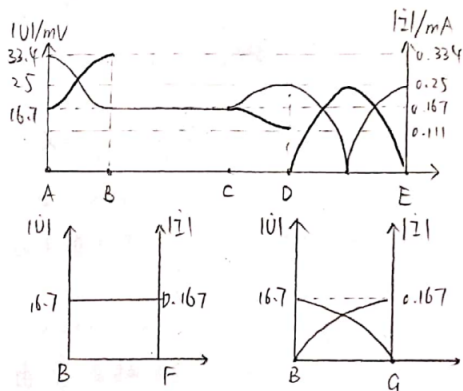
$$|\dot{U}_D(DE)| = |\dot{U}_D| = 25 \text{ mV}$$

$$|\dot{I}_D(DE)| = 0$$

重复性.

$$|\dot{U}_E(DE)| = 25 \text{ mV}, \quad |\dot{I}_E(DE)| = 0$$

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