数学作业纸

2-1φ

甲

解：(a) ① $\leftarrow z$

$u(z,t) = 100\cos(6\pi\times10^8 t + 2\pi z)$

$\dot{U}(z) = 100 e^{j2\pi z}$ mV

无反射波.

$\dot{U}_i(z) = \dot{U}(z) = 100 e^{j2\pi z}$ mV.

$\dot{I}_i(z) = 2 e^{j2\pi z}$

$Z_L = \frac{\dot{U}_i(z)}{\dot{I}_i(z)} = 50\Omega = Z_0$ 阻抗匹配.

$\dot{U}_2 = \dot{U}_{i2} = 100$mV $\quad \dot{I}_2 = \dot{I}_{i2} = 2$mA

$\dot{U}_{r2} = 0 \quad \dot{I}_{r2} = 0$

② $T = \frac{2\pi}{\omega} = \frac{2\pi}{6\pi\times10^8} = \frac{1}{3}\times10^{-8}$ s

$v_p = \frac{\omega}{\beta} = \frac{6\pi\times10^8}{2\pi} = 3\times10^8$ m/s

$\lambda_p = \frac{2\pi}{\beta} = 1$ m.

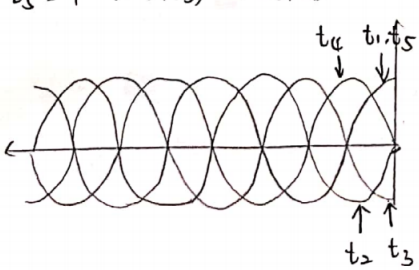
③ $t_1 = 0 \quad u(z,t_1) = 100\cos 2\pi z$

$t_2 = \frac{1}{4}T \quad u(z,t_2) = 100\cos(\frac{\pi}{2} + 2\pi z)$

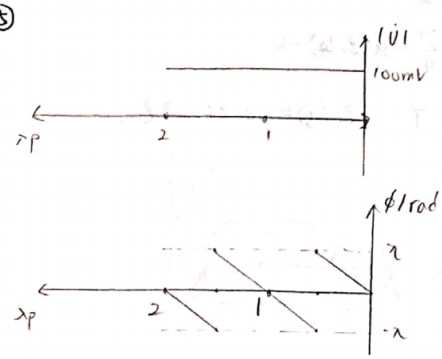
$t_3 = \frac{1}{2}T \quad u(z,t_3) = 100\cos(\pi + 2\pi z)$

$t_4 = \frac{3}{4}T \quad u(z,t_4) = 100\cos(\frac{3\pi}{2} + 2\pi z)$

$t_5 = T \quad u(z,t_5) = u(z,t_1)$



⑤



$\phi = 2\pi z$

⑦ $Z_{in} = Z_0 = 50\Omega$ 不变.

(b) $\leftarrow z$

① $u(z,t) = 100\cos(2\pi z)\cos(6\pi\times10^8 t)$

$\dot{U}(z) = 50(e^{j2\pi z} + e^{-j2\pi z})$

~~$\dot{I}(z) =$~~

$\dot{U}_r(z) = 50 e^{-j2\pi z} \quad \dot{U}_i(z) = 50 e^{j2\pi z}$

$\dot{I}(z) = e^{j2\pi z} - e^{-j2\pi z}$

$\dot{I}_r(z) = -e^{-j2\pi z} \quad \dot{I}_i(z) = e^{j2\pi z}$

$Z_L = \frac{\dot{U}(0)}{\dot{I}(0)} = \infty$

$\dot{U}_2 = 100$mV $\quad \dot{U}_i = 50$mV $\quad \dot{U}_r = 50$mV

$\dot{I}_2 = 0 \quad \dot{I}_i = 1$mA $\quad \dot{I}_r = -1$mA

② $T = \frac{2\pi}{\omega} = \frac{1}{3}\times10^8$ m/s

$\lambda_p = \frac{2\pi}{\beta} = 1$ m.

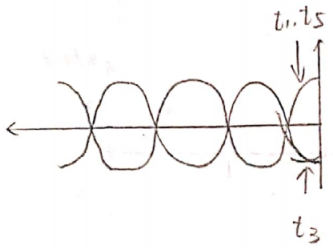
③ $t_1=0$ $u(z,t_1)=100\cos 2\pi z$

$t_2=\frac{T}{4}$ $u(z,t_2)=0$

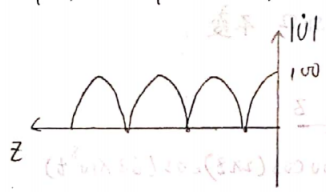
$t_3=\frac{T}{2}$ $u(z,t_3)=-100\cos 2\pi z$

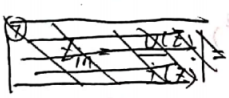
$t_4=\frac{3T}{4}$ $u(z,t_4)=0$

$t_5=T$ $u(z,t_5)=100\cos 2\pi z$.



⑤ 电压幅度 $100|\cos 2\pi z|$

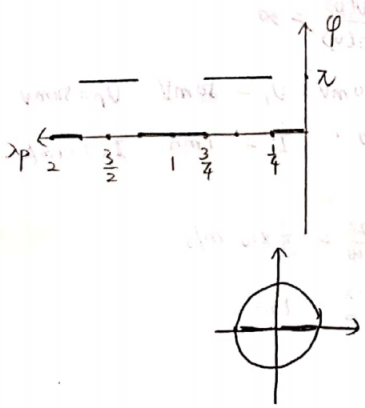




电压 ~~相量~~ 频域：$\dot U=100\cos 2\pi z$

当 $2\pi z\in(-\frac{\pi}{2},\frac{\pi}{2})$ 时 $\dot U>0$ $\varphi=0$

$2\pi z\in(\frac{\pi}{2},\frac{3\pi}{2})$ 时 $\dot U<0$ $\varphi=\pi$



2-12

解：$Z_L=Z_0$ 终端匹配

行波

$u_L(t)=10\sin\omega t$

S_1 处：

~~$u_{L1}(t)$~~ $u_1(t)=10\sin(\omega t+\frac{\pi}{4})$.

$i_1(t)=0.1\sin(\omega t+\frac{\pi}{4})$

S_2 处：

$u_2(t)=10\sin(\omega t+\frac{\pi}{2})$

$i_2(t)=0.1\sin(\omega t+\frac{\pi}{4})$

S_3 处：

$u_3(t)=10\sin(\omega t+\pi)$

$i_3(t)=0.1\sin(\omega t+\pi)$

2-13

解：① $e_g(t)=500\sin\omega t=500\cos(\omega t-\frac{\pi}{2})$

$\dot E_g=500e^{-j\frac{\pi}{2}}$

$Z_g=Z_0$. 则 $\Gamma_g=\frac{Z_g-Z_0}{Z_g+Z_0}=0$.

$Z_L\to\infty$ 则 $\Gamma_L=\frac{Z_L-Z_0}{Z_L+Z_0}=1$.

~~终端是~~

$\dot U(z)=\frac{\dot E_g Z_0}{Z_g+Z_0}\cdot\frac{e^{-j\beta l}}{1-\Gamma_g\Gamma_L e^{-j2\beta l}}(e^{j\beta z}+\Gamma_L e^{-j\beta z})$

~~$f=300MHz$~~

在空气中传播：

数学作业纸

班级： 姓名： 编号： 科目：

2-13.

解：$\dot{E}_g = 500\,e^{-j\frac{\pi}{2}}\ mV$

$Z_g = Z_0$. 波源阻抗匹配

$\Gamma_g = 0$. $\Gamma_L = \dfrac{Z_L - Z_0}{Z_L + Z_0}$.

$$\begin{cases} \dot{U}_i(z) = \dfrac{\dot{E}_g}{2} e^{-j\beta l} \cdot e^{j\beta z} \\ \dot{U}_r(z) = \Gamma_L \dot{U}_i(z) \end{cases}$$

$\beta l = \dfrac{13\pi}{2}$.

① 当 $Z_L \to \infty$.

$\Gamma_L = 1$.

$\dot{U}_{i2} = \dfrac{\dot{E}_g}{2} e^{-j\beta l} = 250\,e^{-j\pi}$

$\dot{U}_{r2} = 250\,e^{-j\pi}$

$\dot{U}_2 = 500\,e^{-j\pi}$

$\therefore u_2(t) = 500\cos(\omega t - \pi) = -500\cos\omega t\ mV$

$\dot{I}_2 = \dfrac{\dot{U}_2}{Z_L} = 0$.

$\therefore \dot{i}_2(t) = 0$

② 当 $Z_L = 80\,\Omega$

$\Gamma_L = \dfrac{80 - 50}{80 + 50} = \dfrac{3}{13}$

$\dot{U}_{r2} = \dfrac{750}{13} e^{-j\pi}$

$\dot{U}_2 = \dfrac{4000}{13} e^{-j\pi}$.

$\therefore u_2(t) = -\dfrac{4000}{13}\cos\omega t\ mV$

$\dot{I}_2 = \dfrac{\dot{U}_2}{Z_L} = \dfrac{50}{13} e^{-j\pi}$

$\therefore \dot{i}_2(t) = -\dfrac{50}{13}\cos\omega t\ mA$