P5.1

(1)

$t=\frac{2L}{v}=\frac{4L}{c}=4\times10^{-9}s=4\,ns$

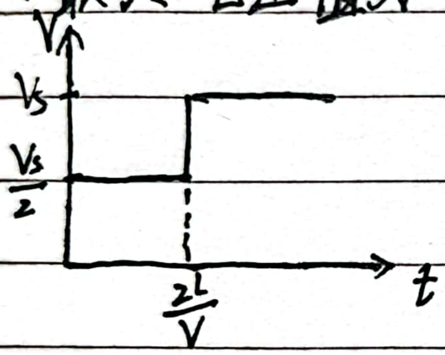
(2)

∵左侧, 阻抗匹配 ∴ $\Gamma_1=0$

∵右侧开路 ∴ $\Gamma_2=1$

$V=V_+e^{-jkz}+\Gamma_2V_+e^{jkz}\big|_{z=0}=2V_+$

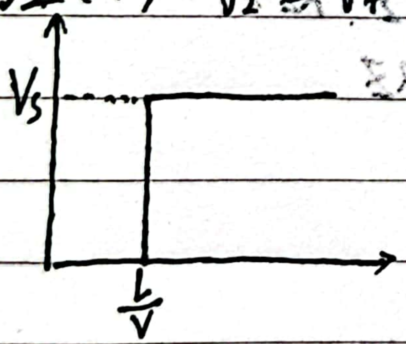
∵最终电压值为 V_s ∴ $V_+=\frac{V_s}{2}$



(3)

同理(2), $V_2=V_++V_-=2V_+=V_s$

∴



P8.2 (第2题)

(1) $I(0) = I_0 = \frac{1}{Z_0}(V_+ \cancel{e^{-jk0}} - V_-)$

$I(-l) = I_0\cos(-kl) = \frac{1}{Z_0}(V_+ e^{-jk\cdot(-l)} - V_- e^{jk(-l)})$

又 ∵ $l = 2\lambda$

∴ 解得: $V_+ = \frac{Z_0 I_0}{2}$, $V_- = -\frac{Z_0 I_0}{2}$

2)

$\Gamma_L = \frac{V_-}{V_+} = -1$

(3)

$\Gamma_L = \frac{Z_{Ln}-1}{Z_{Ln}+1} = \frac{\frac{Z_L}{Z_0}-1}{\frac{Z_L}{Z_0}+1} = -1$

∴ $Z_L = 0$

(4)

$V(z) = Z_0 I_0 \cos kz$

∴ $V(z,t) = Re\{Z_0 I_0 e^{-jkz}\cdot e^{j\omega t}\} = Z_0 I_0 \cos(\frac{\pi}{2} - kz)$

$= Z_0 I_0 \sin kz$

(5)

$I(-l) = I_0\cos(-kl) = I_0$.

∴ $Z_s = \frac{V_s}{I(-l)} = \frac{Z_0 I_0}{I_0} = Z_0$.

P5.3

(1) 在 $t=\frac{1.5L}{V}$ 时，信号还未在 T_2、T_3 右侧发生反射，只在 T_1 右侧发生反射

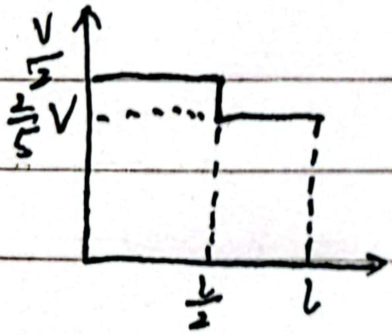
$$Z_{1L}=\frac{2Z_0\cdot Z_0}{2Z_0+Z_0}=\frac{2}{3}Z_0$$

$$\therefore \Gamma_{1L}=\frac{Z_{1L}-Z_0}{Z_{1L}+Z_0}=-\frac{1}{5}$$

由P5.1，~~前面~~可知开关闭合后，$V_+=\frac{V}{2}$，由Z_0分压

$\therefore\ 0\sim0.5L,\ V(z)=\frac{V}{2}$

$\therefore\ 0.5\sim L,\ V(z)=\frac{V}{2}+\Gamma_{1L}V_+=\frac{V}{2}-\frac{V}{10}=\frac{2}{5}V$



(2)

$I_1=I_2+I_3$　　$V_1=V_2=V_3$

由于T_2断路，$I_2=0$

由于T_1、T_3短路，$V_1=V_3=V_2=0$

$\therefore Z_{in}=\frac{V_1}{I_1}=0$　　$\therefore$输入阻抗为0

P5.2 (第4题)

(1)

$H(\vec{r}) = \frac{\vec{k}}{\omega\mu} \times \vec{E} = \hat{y}\frac{k_0}{\omega\mu} e^{ik_0 x/2 + ik_0 z\sqrt{3}/2}$

$\therefore H(\vec{r}) = H(\vec{r})_i + H(\vec{r})_t$，$H(\vec{r})_i = H(\vec{r})_t |_{x=0}$

~~$\therefore H(\vec{r}) = \hat{y}\frac{2k_0}{\omega\mu} e^{ik_0 x/2 + ik_0 z\sqrt{3}/2}$~~

在 $x=0$ 处，$H(\vec{r}) = \hat{y}\frac{2k_0}{\omega\mu} e^{ik_0 z\sqrt{3}/2}$

$\because$ 右侧无磁场

∴由环路定理知：

$\therefore \vec{J}(\vec{r}) = \hat{z}\frac{2k_0}{\omega\mu_0} e^{ik_0 z\sqrt{3}/2}$

(2)

记PEC的阻抗为 $Z=0$

$\therefore \Gamma_x = 0-1$（x方向上）

$\therefore E_{-x} = \Gamma E_{+x}$ $\therefore E_- = (-\hat{x}\sqrt{3}/2 - \hat{z}\frac{1}{2}) e^{-ik_0 x_0/2} e^{ik_0 z\sqrt{3}/2}$

∴在 $x=0$ 处，

$E_+ + E_- = (\hat{x}\sqrt{3}/2 - \hat{z}1/2) e^{ik_0 z\sqrt{3}/2} + (-\hat{x}\sqrt{3}/2 - \hat{z}1/2) e^{ik_0 z\sqrt{3}/2}$

$= -\hat{z} e^{ik_0 z\sqrt{3}/2}$

∴x方向，即 $x>0$ 范围内无场