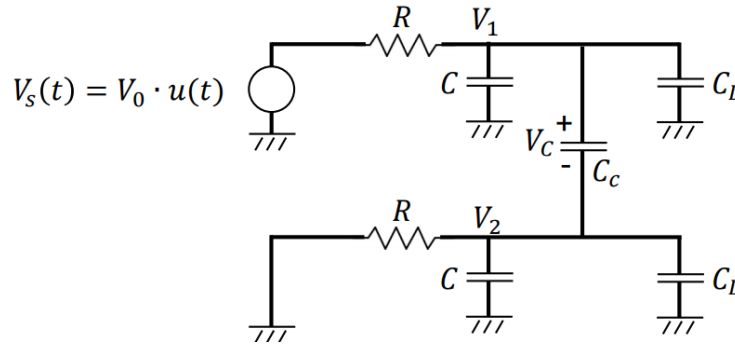


Homework Assignment 14-2

(Due 4:10pm, Apr. 9, email to daehyun@eecs.wsu.edu)

- (1) [Crosstalk, 10 points] Derive $V_1(t)$ and $V_2(t)$ as functions of R, C, C_L, C_C , and V_0 for the following circuit.



$$\frac{1}{R} \left(\frac{V_0}{s} - V_1 \right) = s(C + C_L)V_1 + sC_C(V_1 - V_2)$$

$$sC_C(V_1 - V_2) = \frac{V_2}{R} + s(C + C_L)V_2$$

$$V_1 = \frac{1 + sR(C + C_L + C_C)}{sRC_C} V_2$$

$$V_2(s) = \frac{V_0}{2} \left(\frac{1}{s + 1/\tau_1} - \frac{1}{s + 1/\tau_2} \right)$$

$$\text{Thus, } V_2(t) = \frac{V_0}{2} \left(e^{-\frac{t}{\tau_1}} - e^{-\frac{t}{\tau_2}} \right) \cdot u(t)$$

$$\begin{aligned} V_1(s) &= \frac{V_0}{2RC_C} \left(\frac{1}{s(s + \frac{1}{\tau_1})} - \frac{1}{s(s + \frac{1}{\tau_2})} \right) + \frac{V_0(C + C_L + C_C)}{2C_C} \left(\frac{1}{s + \frac{1}{\tau_1}} - \frac{1}{s + \frac{1}{\tau_2}} \right) \\ &= \frac{V_0}{2RC_C} \left\{ \tau_1 \left(\frac{1}{s} - \frac{1}{s + \frac{1}{\tau_1}} \right) - \tau_2 \left(\frac{1}{s} - \frac{1}{s + \frac{1}{\tau_2}} \right) \right\} + \frac{V_0(C + C_L + C_C)}{2C_C} \left(\frac{1}{s + \frac{1}{\tau_1}} - \frac{1}{s + \frac{1}{\tau_2}} \right) \end{aligned}$$

$$\begin{aligned} \text{Thus, } V_1(t) &= \frac{V_0}{2RC_C} \left(\tau_1 - \tau_1 e^{-\frac{t}{\tau_1}} - \tau_2 + \tau_2 e^{-\frac{t}{\tau_2}} \right) + \frac{V_0(C + C_L + C_C)}{2C_C} \left(e^{-\frac{t}{\tau_1}} - e^{-\frac{t}{\tau_2}} \right) \\ &= V_0 \left(1 - \frac{1}{2} e^{-\frac{t}{\tau_1}} - \frac{1}{2} e^{-\frac{t}{\tau_2}} \right) \cdot u(t) \end{aligned}$$

(2) [Crosstalk, 10 points] Find the encoded string for input 34 using the Near-Optimal FPF-CAC Encoder Algorithm shown in page 25 in the lecture note. Show all the calculation process.

$$m=8, v=34, f_7 = 13, f_8 = 21, f_9 = 34.$$

$$1) 34 \geq f_{m+1} = f_9 = 34 \text{ (true)}$$

$$2) d_m = d_8 = 1.$$

$$3) r_m = r_8 = v - f_m = 34 - 21 = 13.$$

$$4) k = m - 1 = 7.$$

$$5) r_{k+1} = r_8 = 13 \geq f_{k+1} = f_8 = 21 \text{ (false)}, r_8 = 13 < f_k = f_7 = 13 \text{ (false)}$$

$$6) d_k = d_{k+1}, \text{ so } d_7 = 1.$$

$$7) r_k = r_7 = r_{k+1} - f_k d_k = 13 - 13 \cdot 1 = 0.$$

$$8) k = 6. \text{ Since } r_{k+1} = 0, d_6 = 0, \text{ and all the other } d \text{ values are zero.}$$

Answer: 11000000