

電路學期末考

1. (10%) Find $v(t)$ for $t > 0$ in Fig. 1 when $C = 1/300$ F and

$$V_s(t) = 4 \text{ V} \quad t < 0$$

$$= 11 \cos(5t - 90^\circ) \text{ V} \quad t > 0$$

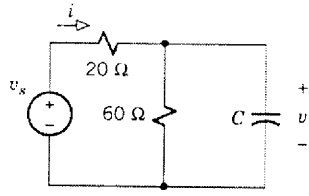


Fig. 1

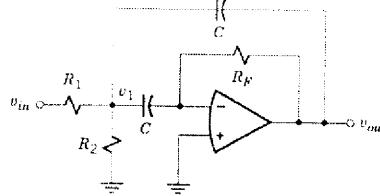


Fig. 3

2. (15%) A source is connected to a remote load by a transmission line with transformers at each end, as shown in Fig. 2. By referring the source and load into the middle section, find I , I_{in} , and all the voltage phasors (V_{in} , V_a , V_b and V_{out}) when $N_a = 5$, $Z = 30 + j 30 \Omega$, $N_b = 4$, and $Z_{out} = 800 - j 32 \Omega$.

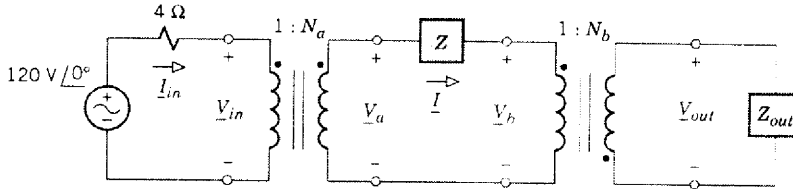


Fig. 2

3. For the circuit shown in Fig. 3, assume that the op-amp is ideal, $R_1 = R_2 = \frac{1}{C} = R$ and the input has the following general form: $v_{in}(t) = V_m e^{\sigma t} \cos(\omega t + \phi_{in})$. (a). Find the network function $H(s) = \underline{V}_{out} / \underline{V}_{in}$, where \underline{V}_{out} and \underline{V}_{in} are phasors associated with $v_{out}(t)$ and $v_{in}(t)$, respectively. (10%) (b). If all resistance and capacitance values are positive, verify if the network is stable and explain why. (5%). (c). Find the step response when $R_1 = R_2 = R_F = \frac{1}{C} = 1$. (10%)
4. If the impulse response of a linear time-invariant circuit is given as $h(t) = u(t) \frac{A}{T} \exp[-\frac{t}{T}]$, where $u(t)$ is the step function. Find the zero state response of the circuit due to an input $i_s(t) = I_m [u(t - T) - u(t - 5T)]$. (20%)
5. (a) Please derive the ABCD parameters in terms of h-parameters. (15%)

- (c) Design the circuit in Fig. 4 to have $A_i = \frac{I_{out}}{I_s}$ with $R_L = 5k\Omega$.

The h parameters are $A_i = \frac{I_{out}}{I_s} = \begin{bmatrix} 1k\Omega & 10^{-3} \\ 50 & 0.1mS \end{bmatrix}$. (15%)

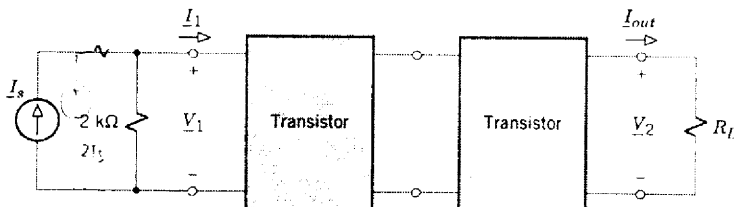


Fig. 4