

所 別： 電機工程技術研究所  
學 程 別：

組 別： 電力組

科 目： 電路學

1. Consider the circuit shown in Fig. 1.
- Obtain the state equations for the circuit of Fig. 1. (5%)
  - If the input voltage is unit step function  $e(t)=u(t)$  V and initial conditions  $i_L(0)=1A$ ,  $v_c(0)=2V$ , calculate the current  $i_L(t)$  and voltage  $v_c(t)$ . (10%)
  - If the input voltage  $e(t)=100\sin(5t)$  V, calculate the steady- state current  $i_L(t)$  and voltage  $v_c(t)$ . (10%)

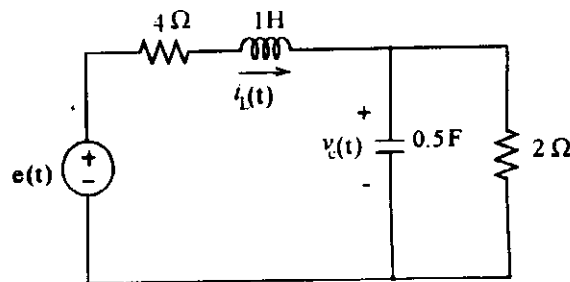


Fig. 1

2. In the circuit of Fig.2, the parameters are  $R_1 = 20 \Omega$ ,  $R_2 = 20 \Omega$ ,  $L = 0.1H$ ,  $C = 200 \mu F$ , and  $e_s(t) = 141.4\sin(377t)$  V.
- Find the impedance  $Z$  when  $aa'$  and  $bb'$  are not connected. (5%)
  - With  $aa'$  and  $bb'$  connected, find the steady- state current  $i_s(t)$  and voltage  $v_2(t)$ . (10%)
  - Find the average power delivered to  $R_1$  and  $R_2$ . (10%)

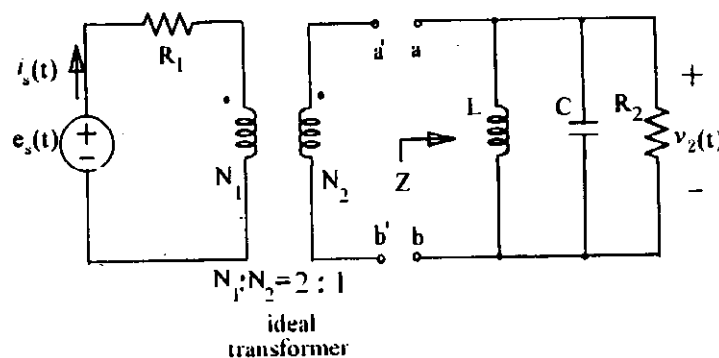


Fig. 2

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3. For the three-phase system shown in Fig. 3, let  $V_{ab} = 220\angle 0^\circ$  V,  $V_{bc} = 220\angle -120^\circ$  V,  $V_{ca} = 220\angle 120^\circ$  V.

- (a) Determine the current  $I_{Aa}$ . (10%)  
(b) Determine the voltage  $V_{ab}$ . (10%)

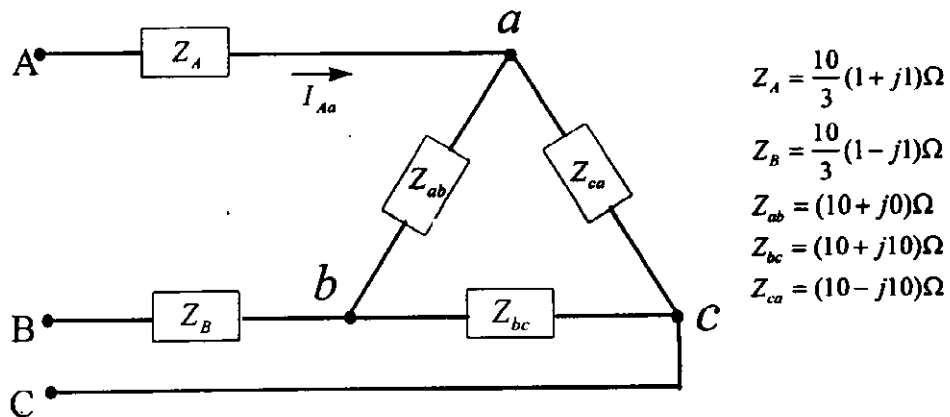


Fig. 3

4. Consider the ideal op-amp. circuit of Fig. 4 with  $R = 10K\Omega$  and  $C = 100\mu F$ .
- (a) Find the transfer function  $V_o(s)/V_i(s)$ . Let  $V_o(s)$  and  $V_i(s)$  be the Laplace transform of  $v_o(t)$  and  $v_i(t)$ . (10%)
- (b) If  $v_i(t) = \sin t$  V, find the steady-state response of  $v_o(t)$ . (5%)

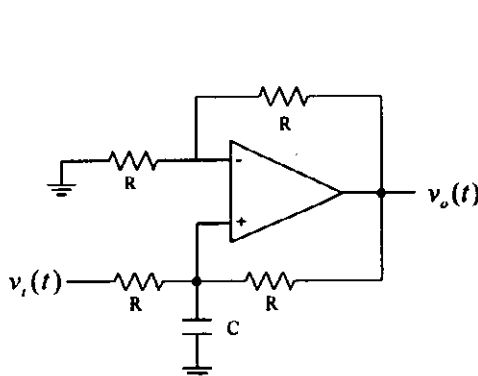


Fig. 4

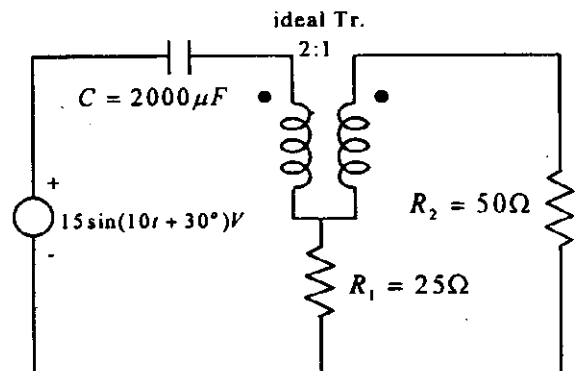


Fig. 5

5. Determine the average power absorbed by  $R_2$  in the circuit of Fig. 5. (15%)