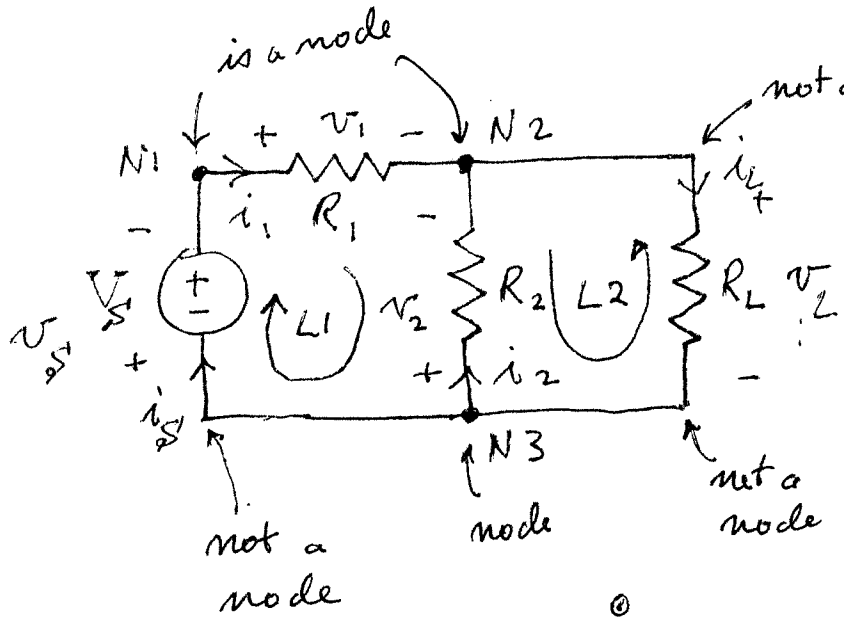
2023-2-9 L01B
Supplement



② N1 $\Rightarrow$ $i_{s'} - i_1 = 0$ ① N2 $\Rightarrow$ $i_1 + i_2 - i_L = 0$ ②

③ $v_{s'} + v_1 - v_2 = 0$ ③ L2: $\Rightarrow$ $-v_2 - v_L = 0$ ④

L1: $\Rightarrow$

④ $-V_{s'} = v_{s'}$ ⑤, $v_1 = i_1 R_1$ ⑥, $v_2 = i_2 R_2$ ⑦, $v_L = i_L R_L$ ⑧

$\Rightarrow$ 8 eq'ns & 8 unknowns.

1st subst. ⑥ into ③ $\Rightarrow$ $-V_{s'} + v_1 - v_2 = 0$ (1)

subst. ⑥, ⑦, ⑧ into ② $\Rightarrow$ $\frac{v_1}{R_1} + \frac{v_2}{R_2} - \frac{v_L}{R_L} = 0$ (2)

subst ④ into (2) rearranged to $v_L = -v_2$ $\Rightarrow$ $\frac{v_1}{R_1} + \frac{v_2}{R_2} + \frac{v_2}{R_L} = 0$ (3)

solve (1) for v_1 & subst. into (3)

$v_1 = v_2 + V_{s'}$ $\Rightarrow$ $\frac{v_2 + V_{s'}}{R_1} + \frac{v_2}{R_2} + \frac{v_2}{R_L} = 0$ (4)

solve (4) for v_2

$$v_2\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_L}\right) = -\frac{V_{s'}}{R_1} \Rightarrow v_2 = \frac{-V_{s'} R_1 R_2 R_L}{R_L} \frac{1}{R_2 R_L + R_1 R_L + R_1 R_2}$$

take lim as $R_L \to \infty$ to check

$$\Rightarrow v_2 = -V_{s'} R_2 / R_1 + R_2$$