

### Question 1

For the coupled circuit of Fig. 1, the reciprocal inductance matrix is

$$\Gamma = \begin{bmatrix} \Gamma_{11} & \Gamma_{12} & \Gamma_{13} \\ \Gamma_{12} & \Gamma_{22} & \Gamma_{23} \\ \Gamma_{13} & \Gamma_{23} & \Gamma_{33} \end{bmatrix}$$

and the initial conditions are

$$v_c(0^-) = V_0, \quad i_{L_1}(0^-) = I_1, \quad i_{L_2}(0^-) = I_2, \quad i_{L_3}(0^-) = I_3$$

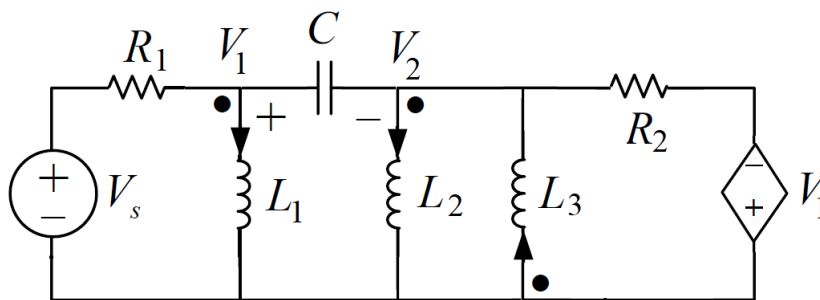


Figure 1: A coupled circuit.

(a) Write the Laplace-domain node equations.

(b) Write the time-domain node equations.

(c) Write the phasor-domain node equations.