정보통신 수학 및 실습
Homework

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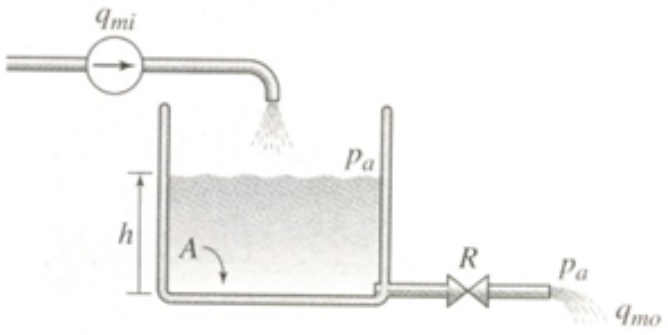
Chapter 8 Homework

1. **If the outlet is a pipe that discharges to atmospheric pressure pa and provides a resistance, R, to flow that is proportional to the pressure difference across its ends, then find the outlet flow rate qmo and the differential equation of h(t). Hint: qmo is (1/R)* (the pressure difference across its ends)**



A hydraulic system with a flow source.

$$\frac{dm}{dt} = \rho A \frac{dh}{dt} = q_{mi} - q_{mo}$$

$$q_{mo} = q_{mi} - \rho A \frac{dh}{dt} = \frac{1}{R} P = \frac{\rho h(t)}{R}$$

$$q_{mi} - \rho A \frac{dh(t)}{dt} = \frac{\rho h(t)}{R}$$

2. **Find a DE for the following circuits.**

a)

$$Q = CV$$

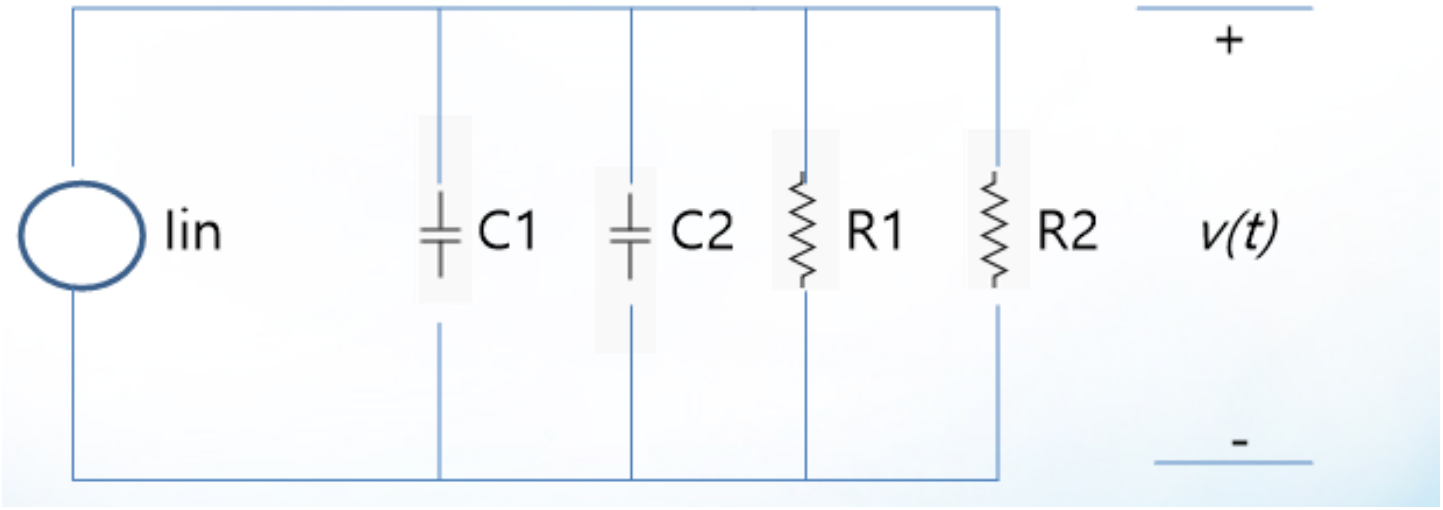
$$V = \frac{Q}{C}$$

$$V(t) = \frac{1}{C} \int_{t_0}^{t} I(t) + V(t_0)$$

$$\because Q = \int_{t_0}^{t} I(t)$$

$$V = L \frac{dI(t)}{dt}$$

$$C \frac{dV(t)}{dt} = I(t)$$



$$V_s(t) = V_{C1}(t) = V_{C2}(t) = V_{R1}(t) = V_{R2}(t)$$

$$I_s(t) = I_{C1}(t) + I_{C2}(t) + I_{R1}(t) + I_{R2}(t)$$

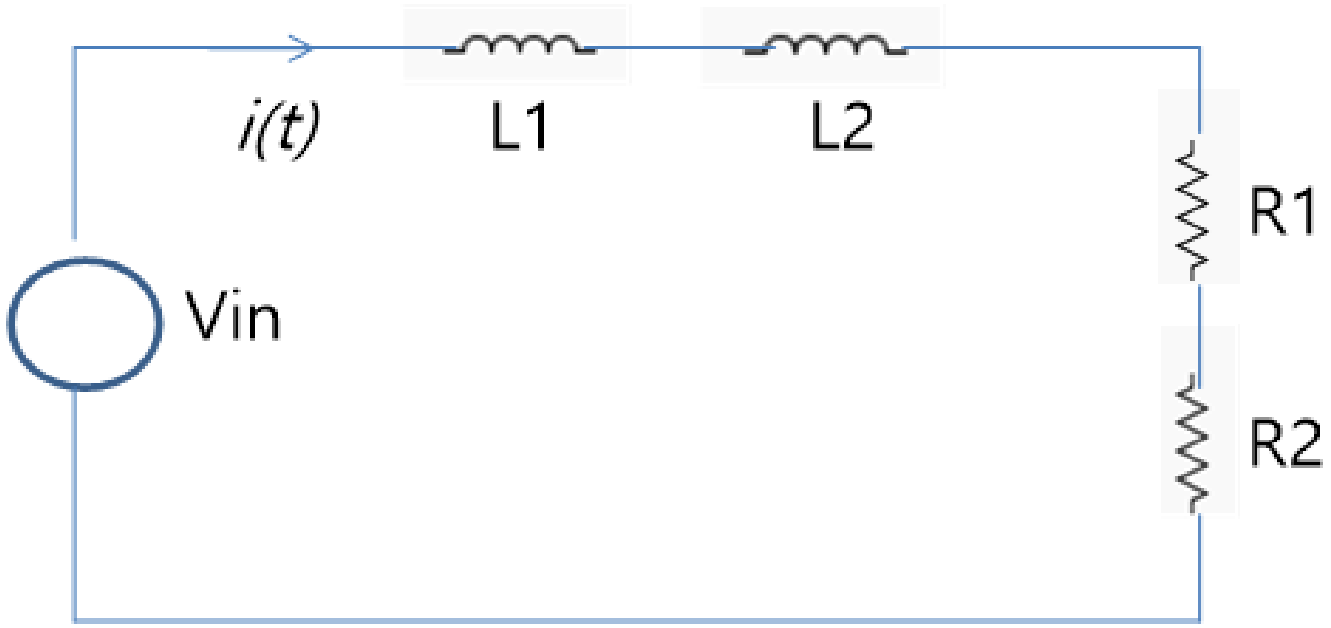
$$I_s(t) = C1\frac{dV_{C1}(t)}{dt} + C2\frac{dV_{C2}(t)}{dt} + \frac{V_{R1}(t)}{R1} + \frac{V_{R2}(t)}{R2}$$

$$\because Q = CV = \int I(t)$$

$$C\frac{dV}{dt} = I(t)$$

$$I_s(t) = C1\frac{dV_s(t)}{dt} + C2\frac{dV_s(t)}{dt} + \frac{V_s(t)}{R1} + \frac{V_s(t)}{R2}$$

b)



$$V_s(t) = V_{L1}(t) + V_{L2}(t) + V_{R1}(t) + V_{R2}(t)$$

$$V_s(t) = L1\frac{dI(t)}{dt} + L2\frac{dI(t)}{dt} + I(t)R1 + I(t)R2$$