정보통신 수학 및 실습
Homework

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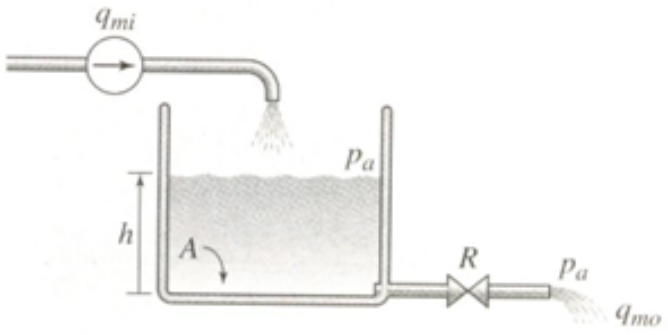
Chapter 8 Homework

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.

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

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

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

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

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

$$h(k+1) = \frac{\Delta t}{A}(\frac{q_{mi}}{\rho} - \frac{h(k)}{R}) + h(k)$$

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

a)

$$Q = CV$$

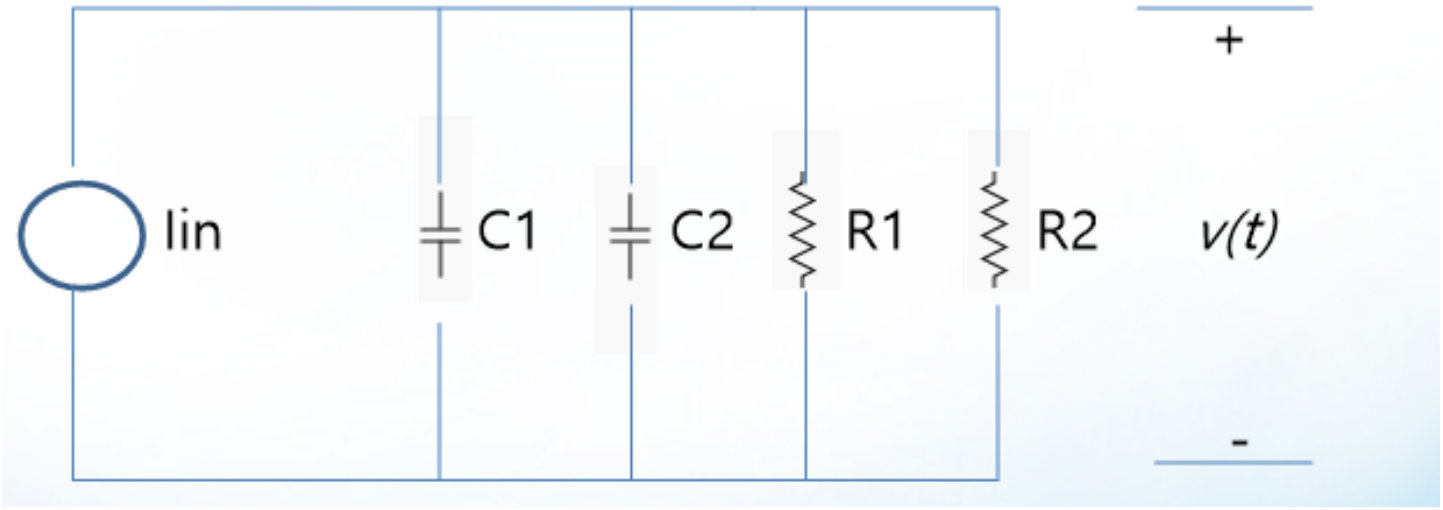
$$V = \frac{Q}{C}$$

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

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

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

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



b)