EE352 - AUTOMATIC CONTROL

Week 5 Activity 1

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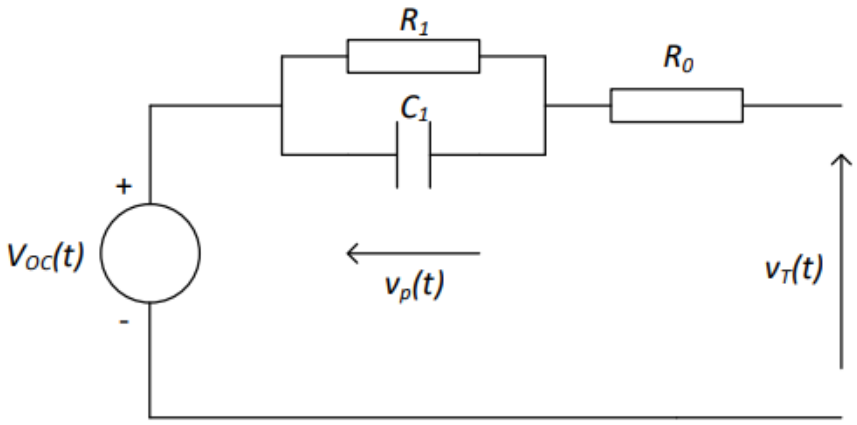

Figure 1: Circuit Diagram

Given that,

$$\frac{dSOC(t)}{dt} = \frac{i(t)}{Q} \tag{1}$$

$$V_{OC}(t) = k.SOC(t) \tag{2}$$

Applying KVL to the circuit gives,

$$\begin{aligned} V_{OC}(t) &= V_T(t) + v_p(t) + R_0 i(t) \\ V_T(t) &= k.SOC(t) - v_p(t) - R_0 i(t) \end{aligned} \tag{3}$$

For the capacitor,

$$\begin{aligned} i(t) - \frac{v_p(t)}{R_1} &= C_1 \frac{dv_p(t)}{dt} \\ \frac{dv_p(t)}{dt} &= \frac{1}{C_1} i(t) - \frac{1}{R_1 C_1} v_p(t) \end{aligned} \tag{4}$$

Using 1 and 4,

$$\begin{bmatrix} \frac{dv_p(t)}{dt} \\ \frac{dSOC(t)}{dt} \end{bmatrix} = \begin{bmatrix} -\frac{1}{R_1 C_1} & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} v_p(t) \\ SOC(t) \end{bmatrix} + \begin{bmatrix} \frac{1}{C_1} \\ \frac{1}{Q} \end{bmatrix} i(t)$$

Using equation 3,

$$V_T(t) = \begin{bmatrix} -1 & k \end{bmatrix} \begin{bmatrix} v_p(t) \\ SOC(t) \end{bmatrix} - \begin{bmatrix} R_0 \end{bmatrix} i(t)$$