

EEE 225 - Engineering Mathematics I
(Differential Equations)
Homework 10

19th Dec, 2022

1. Figure 1 shows the circuit prior to a switch being thrown at time $t = 0$. We assume that at $t = 0$ the circuit has been in the configuration shown in Figure 1 long enough for the circuit to reach steady state. In the steady state the voltage over the capacitor v_1 equals the constant input voltage v_s .

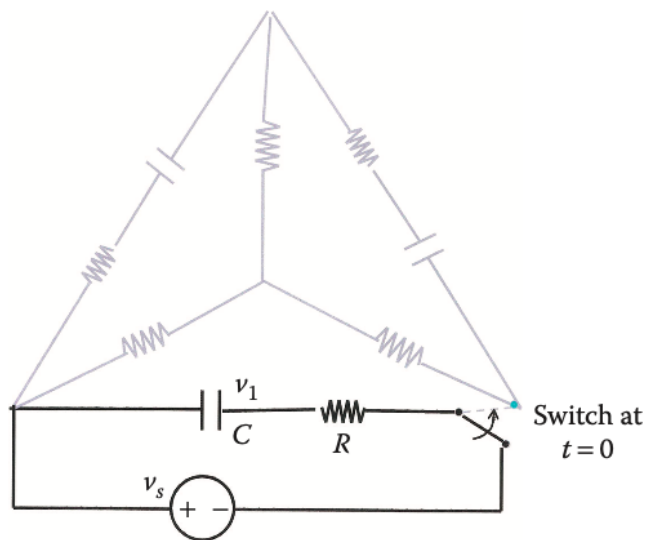


Figure 1: Electric circuit prior to switch being thrown.

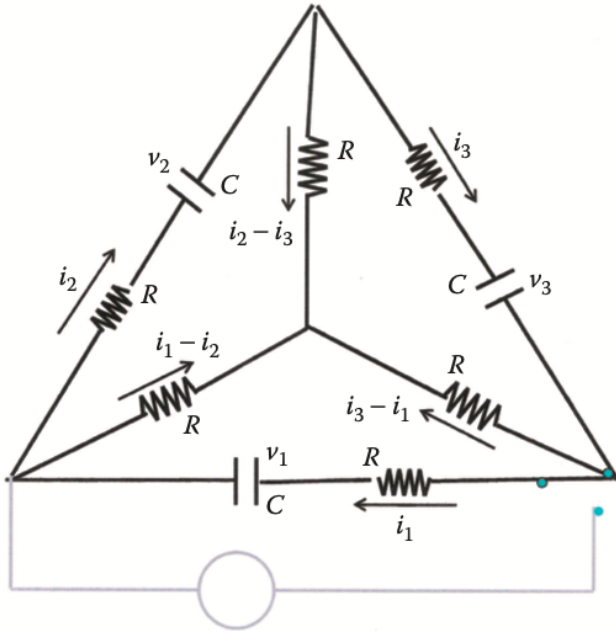


Figure 2: Electric circuit after switch.

Figure 2 pictures the circuit after $t = 0$ and shows the important circuit variables. All the resistors have the same value R and all the capacitors the same value C . We want to determine the behaviour of the circuit after $t = 0$.

Solve

$$\frac{d\underline{x}}{dt} = \underline{A} \underline{x} \quad (1)$$

where

$$\underline{x}(0) = \begin{pmatrix} v_s \\ 0 \\ 0 \end{pmatrix} \quad (2)$$

and

$$\underline{A} = \frac{-1}{4RC} \begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{pmatrix} \quad (3)$$