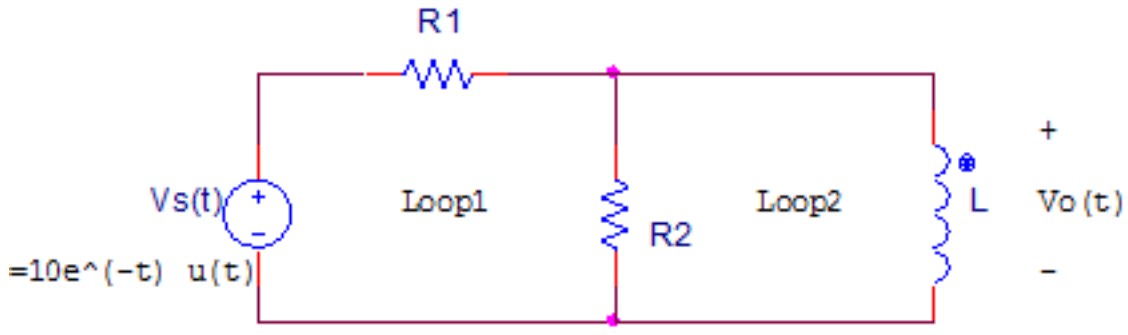
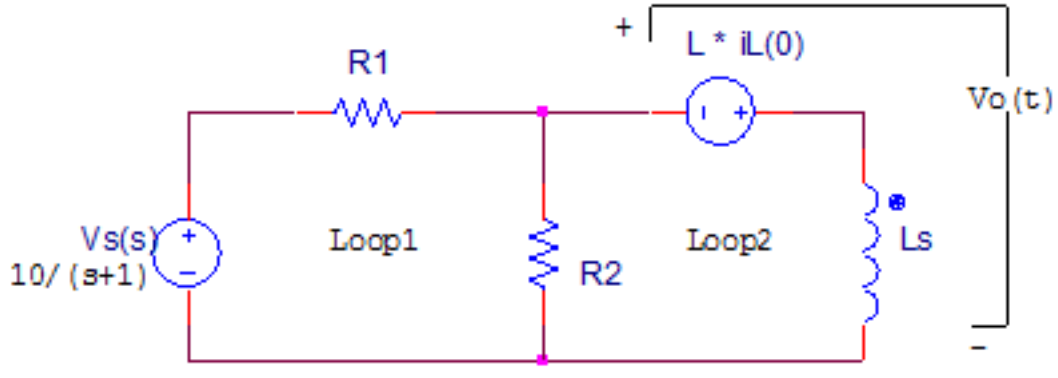


Original circuit in time domain



My transformation of the circuit to the s – domain

Given:

Vs(t) = $10\,e^{-t}\,u(t)$
$R_1 = R_2 = 10\,\Omega$
L = 1H
iL(t=0) = .5A
Let $R = R_1 + R_2$
Let i_1 be the current in Loop1 and i_2 be the current in Loop2

My approach:

for t>0,

Loop1: $\frac{10}{s+1} - i_1 R_1 - (i_1 - i_2) R_2 = 0$

$\Rightarrow \frac{10}{s+1} = i_1 R_1 + i_1 R_2 - i_2 R_2$

$\Rightarrow i_1 = \frac{10/(s+1) + i_2 R_2}{R}$

Loop2: $-(i_2 - i_1) R_2 + L\,iL(0) - Ls = 0$

$\Rightarrow -i_2 R_2 + i_1 R_2 + .5 - Ls = 0$

$\Rightarrow -i_2 R_2 + \frac{(10 R_2)/(s+1) + i_2 R_2^2}{R} + .5 - Ls = 0$

$$\Rightarrow i_2 \left(\frac{R_2^2}{R} - R_2 \right) + \frac{10\, R_2}{R\,(s+1)} + .5 - Ls = 0$$

$$\Rightarrow i_2 \left(\frac{100}{20} - 10 \right) + \frac{100}{20\,(s+1)} + .5 - s = 0$$

$$\Rightarrow -5\, i_2 + \frac{5}{s+1} + .5 - s = 0$$

$$\Rightarrow i_2 = \left[\frac{5}{s+1} + .5 - s \right] \Big/ 5$$

$$\Rightarrow i_2 = \frac{1}{s+1} + .1 - \frac{s}{5}$$