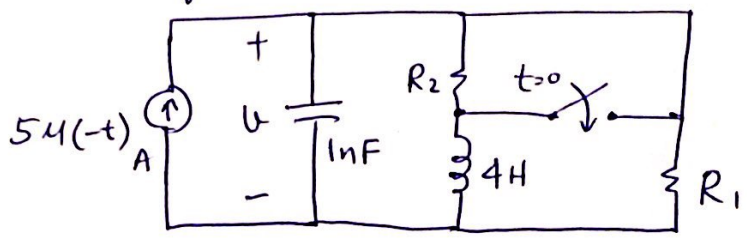
(Optional)
(Basic)
~~(Nil)~~

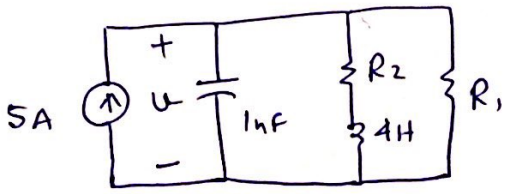
Example 9.5 Critically Damped Response

(PP 335 7th Ed HKD) (PP 337 8th Ed)

Select a value of R_1 such that the following circuit will be characterized by a critically damped response for $t > 0$ and a value of R_2 such that $v(0) = 2$ V.



Solution: At $t < 0$



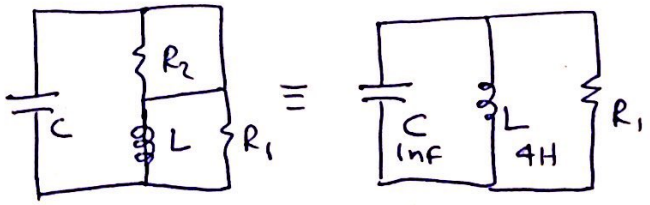
$$v(0^-) = 5(R_2 // R_1) = 5R_2$$ {when R_1 is very large}

Note: Or we can calculate R_1 first and put in the value

To get $v(0) = 2$ V

we choose $R_2 = 400\ m\Omega$

Now at $t > 0$



Here $\alpha = \frac{1}{2RC} = \frac{1}{2 \times 10^{9} R_1}$

and $\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{4 \times 10^{-9}}} = 15,810$ rad/s

——— Contd

(Optional)
(Basic)
(~~Ato~~)

—contd (335)

For critically damped response $\alpha = \omega_0$

So $\frac{1}{2 \times 10^{-9} R_1} = 15.81 \times 10^3$

$R_1 = 31.63 \text{ K}\Omega$