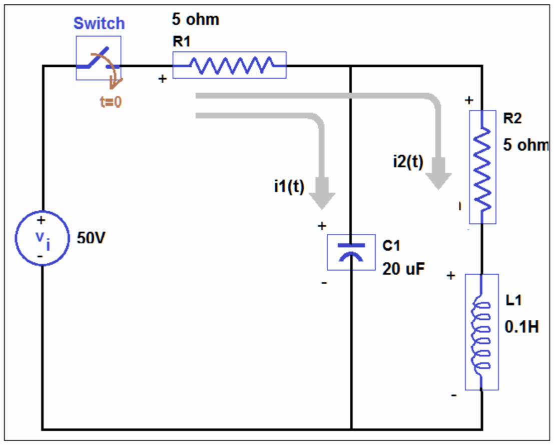
Supplementary Problem 8.27 (Mesh RLC circuit) :



In the two mesh circuit provided, the switch is closed at t=0. Find i1 and i2 for t>0.

$R1 := 5$ Ohm

$R2 := 5$ Ohm

$C1 := 20 \cdot 10^{-6}$ F

$L1 := 0.1$ H

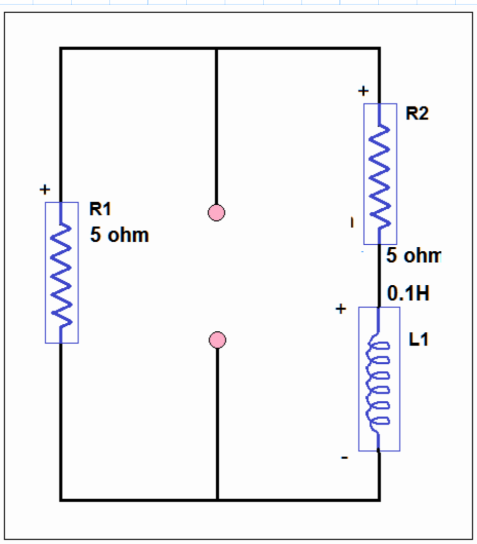
$$\frac{1}{C1} = 50000$$

$Vi := 50$ V

What Happened Here? 2 or 3 solution methods attempted. 1 method was creating differential equations and solving them simultaneously, with initial conditions. This did not produce the textbook answer. There was the question on how to distinguish the time constants which there were two. Over/Under/Critical damped conditions were considered. Roots, s1 and s2, of equation method did not get to the answers. That left me with my last option using type component initial conditons with voltage and current equations.

Solution (Errors and Assumptions) :

How do we deicide on the connection of this circuit time constant wise ? Series Or Parallel RLC? Maybe a mix of both? RL or RC time constant.



RL time constant (end condition):

R1 and R2 in series. Vi removed.

At time t>0 end condition the capacitor C1 is open circuit. Inductor shown but it is taken for short circuit it exists in the circuit for continous current. Capacitor fully charged.

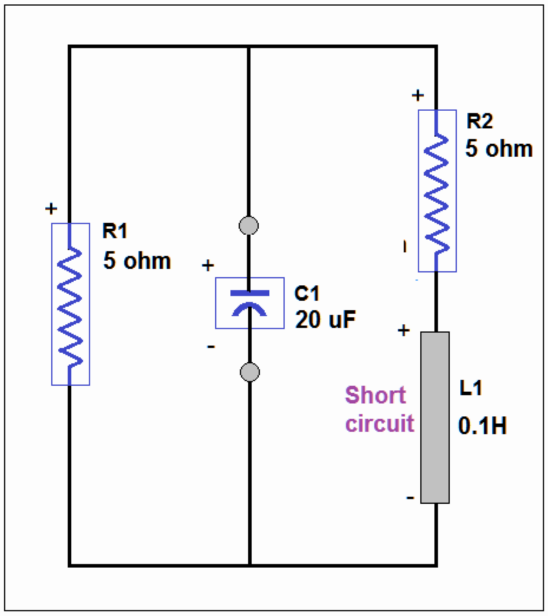
Here we have an RL series circuit.

Time constant:

$R12 := R1 + R2 = 10$

$$\tau_{R1L1} = \frac{L1}{R12} = 0.01$$

$$\frac{1}{\tau_{R1L1}} = \frac{R12}{L1} = 100$$ Steady state condition.



RC circuit (0<t<infinity condition):

For time t: $t < \infty$

R1 and R2 parallel.

At time t>0 end condition the Inductor is short circuit. Capacitor shown but it is taken for open circuit. Neglect inductor since I accounted for it in t=infinity.

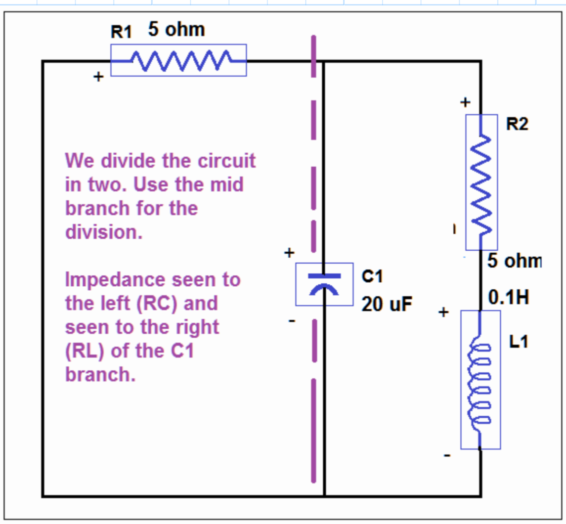
Here we have an RC parallel circuit.
Lets say both L and C are playing their roles. L impacting mid point and end, and C before end, at t=infinity C is not contributing to time constant.

Capacitor is playing an increasing impeding role as time approahces infinity. It turns into an open circuit.

For time t: $0 < t < \infty$

$$\tau_{R1C1} = R1 \cdot C1 = 1 \cdot 10^{-4}$$

$$\frac{1}{\tau_{R1C1}} = \frac{1}{1 \cdot 10^{-4}} = 10000$$



RL mid-point operation (0<t<infinity):

Left side circuit is RC parallel.
Right side circuit is RL series.

For time t: $t < \infty$

$$\tau_{R2L1} = \frac{L1}{R2} = 0.02$$

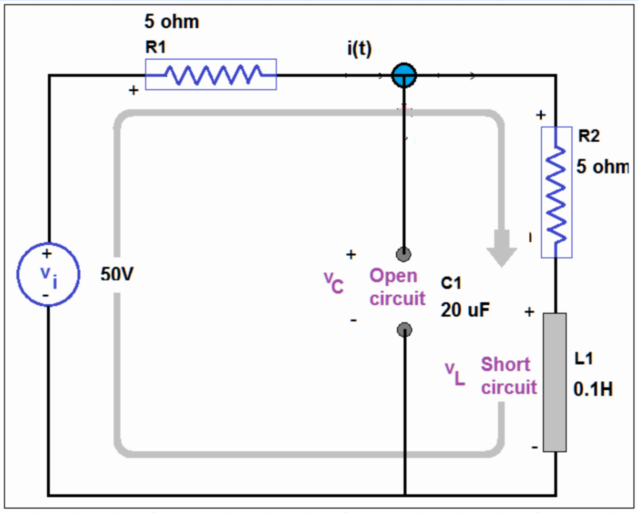
$$\frac{1}{\tau_{R2L1}} = \frac{1}{0.02} = 50$$

Circuit condition above is when there is no external source, and the circuit has 2 time constant connections, RC and RL, both time constants are working on the circuit, the resultant of which is the net difference. One impacting the other, results in net difference. *Current phase angle is opposing between L and C, that may result in a difference in time constant. Voltage is the same across L and C.*

$$\frac{1}{\tau_{Net}} = \frac{1}{\tau_{R1C1}} - \frac{1}{\tau_{R2L1}} = 10000 - 50 = 9950 \qquad \text{<--- (0< t <infinity)}$$

Next work on the current and voltage based on some conditions.

Based on circuit end conditions :
There is one loop, C1 open circuit, and L1 short circuited, with voltage 50V and 2 resistors are in series. We can calculate current i_end(t) :



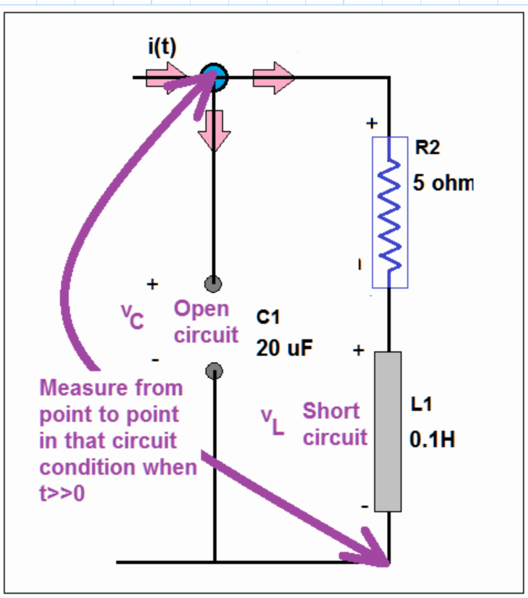
$$i(\infty) := \frac{Vi}{R1 + R2} = 5 \quad \text{A.}$$

Voltage across R2 at t = infinity :

$$v_{R2}(\infty) = 5 \cdot 5 = 25 \quad \text{V}$$

Also

$$v_{R1}(\infty) = 5 \cdot 5 = 25 \quad \text{V}$$



From the circuit shown in the left we agree the voltage across the capacitor in time t=infinity will equal that across the branch of the components R2 and L1. vL1 =0 its shorted, current flows.

$$v_{C\_t\_end}(\infty) = v_{R2}(t) + v_{L1\_end}(t)$$

$$= 25 + 0 \quad \text{V.}$$

$$= 25 \quad \text{V.}$$

Knowing the end condition of C1 voltage, an expression can be written for C1 voltage :

$$v_{C1}(t) = V_m \cdot \left(1 - e^{\frac{-t}{\tau_{R2L1}}}\right)$$

We form v_C1(t) based on the waveform seen across R2 and L1 the other branch. Using the RL time constant. Lets say here I say the capacitor is open circuit its steady state condition for t=infinity applies.

$$v_{C1}(t) = 25 \cdot \left(1 - e^{-100\,t}\right)$$

With a large t, the final voltage is 25V end condition but this can represent the voltage from t=0 to t=infinity with both parts of the expression.

Capacitor Equation:

$$v_{C1}(t) = \frac{1}{C1} \cdot \int i_c(t)\,dt$$

$$C1 \cdot v_{C1} = \int i_c(t)\,dt$$ <-- next the derivative on both sides wrt dt.

$$C1 \cdot \frac{dv_C}{dt} = i_C(t) - i_C(0)$$

$$\frac{dv_{C1}}{dt} = \frac{i_C(t) - i_C(0)}{C1}$$

Take the derivative of the voltage v_c(t) :

$$v_{C1}(t) = 25 \cdot \left(1 - e^{-100\,t}\right) = 25 - 25\,e^{-100\,t}$$

Time constant 100 for end condition (RC).

$$\frac{d\_v_{C1}(t)}{dt} = 0 - 25 \cdot 100\,e^{-100 \cdot t} = -2500 \cdot e^{-100 \cdot t}$$

Note above ---> $\frac{dv_{C1}}{dt} = \frac{i_C(t) - i_C(0)}{C1}$ Therefore $C1\left(\frac{dv_{C1}}{dt}\right) = i_C(t) - i_C(0)$

$$C1 \cdot \left(\frac{d\_v_{C1}}{dt}\right) = 20 \cdot 10^{-6} \cdot \left(-2500 \cdot e^{-100 \cdot t}\right) = -0.05\left(e^{-100 \cdot t}\right)$$

$$i_C(t) - i_C(0) = C1 \cdot \frac{d\_v_{C1}}{dt} = -0.05\left(e^{-100 \cdot t}\right) = -0.05\left(e^{-100 \cdot t}\right) - \left(-0.05\left(e^{-100 \cdot 0}\right)\right)$$

Lim t to t=0 Lim t to t=0

iC(t=0+) = iC(t=0) = 0

$$= -0.05\left(e^{-100 \cdot t}\right) + 0.05$$

$$i_C(t) - 0 = i_{C1}(t) = i1(t) = 0.05 - 0.05\left(e^{-100 \cdot t}\right) \text{ A.}$$

This the steady state current.

Inductor Equation (Approach A):

For time t<infinity, capacitor voltage could takes same wave form as across R2 and L1 branch. I give it a try, its part of the circuit's branch.

$$vR2 + L1\left(\frac{di2}{dt}\right) = 25 + L1\left(\frac{di2}{dt}\right) = v_{C1}(t) = 25 \cdot \left(1 - e^{-100\,t}\right)$$

$$25 + L1\left(\frac{di2}{dt}\right) = 25 - 25 \cdot e^{-100\,t}$$

$$v_{L1}(t) = L1\left(\frac{di2(t)}{dt}\right) = -25\,e^{-100 \cdot t}$$

$$\left(\frac{di2}{dt}\right) = \frac{v_{L1}(t)}{L1} = \left(\frac{1}{0.1}\right)\left(-25\,e^{-100 \cdot t}\right) = -250 \cdot e^{-100 \cdot t}$$

Is this right equating it to the capacitor branch, instead of the 50V voltage source and resistor R1 branch? Continue on and update as required.

$$\left(\frac{di2(t)}{dt}\right) = -250 \cdot e^{-100 \cdot t}$$

$$di2(t) = -250 \cdot e^{-100 \cdot t}\, dt$$

Integrating both sides: $\int_0^t i2(t)\,dt = \int_0^t -250 \cdot e^{-100 \cdot t}\,dt$ Lim 0 --> t decaying.

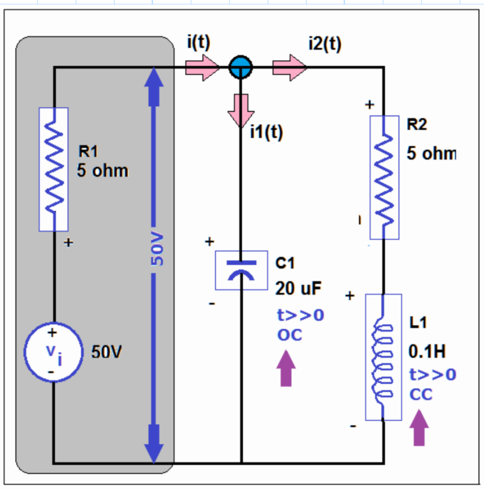
At time t=0, iL(0+) = iL(0) = 0. Therefore L1*i2(0) = 0.

$$i2(t) - i2(0) = i2(t) - 0 = i2(t) = \int_0^t -250 \cdot e^{-100 \cdot t}\,dt = \frac{-250}{-100} e^{-100\,t} = 2.5\, e^{-100\,t}$$

$$i2(t) = 2.5\, e^{-100\,t} - 2.5\, e^{-100\,0} = 2.5\, e^{-100\,t} - 2.5$$ Plots on next page.

Lim t to t=0

This the steady state current? Maybe NOT. I got an expression but the capacitor is a changing waveform it has a rise and decay. What if the voltage source branch was used to equate to the L1 and R2 branch? A more steady waveform from a source and runs thru for circuit end condition.



I work approach this time equating to 50V.

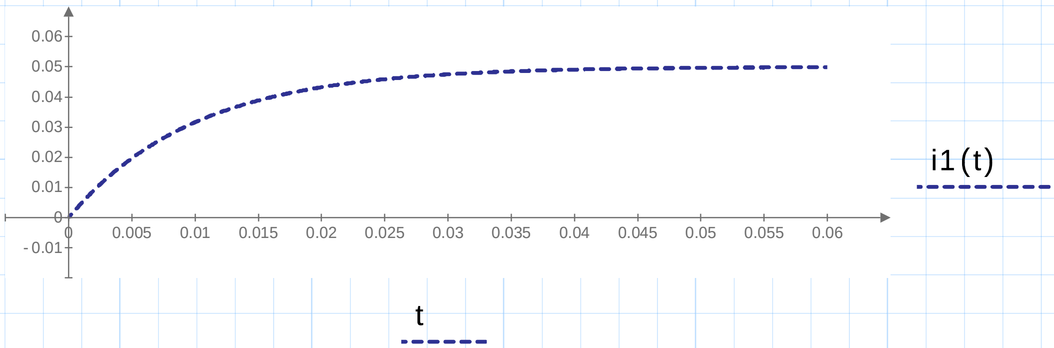
Discussion:
Voltage across the Vi and R1 branch is 50V, it may does look like thats not the case, since there is a voltage drop across the resistor R1. But the total voltage across the branch is 50V from end to end is 50V. Voltage at node can be 50-vR1. That is one reason why I choose the C1 branch prior should it be more certain. If I look at Vi as all voltage and no impdeance and removed it from the circuit leaving R1 what then is the voltage across R1 in this branch? Maybe 50V.

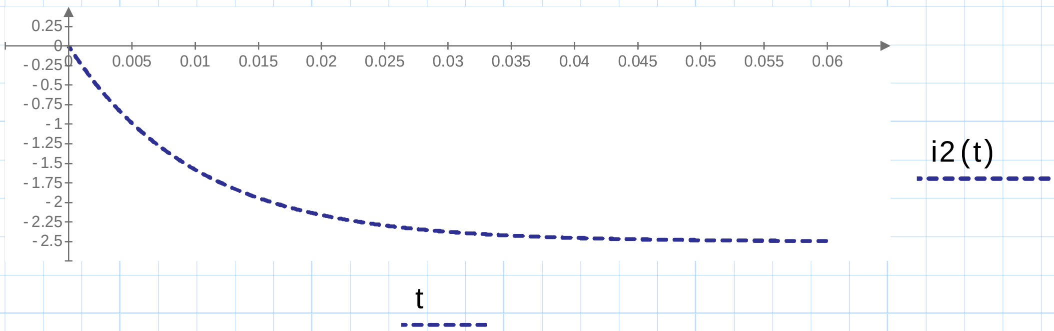
The circuit to the left, the argument or case I am making was with the voltage removed, for usually getting the equivalent impedance of the circuit, what is the voltage across the R1 resistor?
Could it be 50V or it be 25V under the condition of t>>0 or t=infinity?
Since I am working in the 0<t<infinity then maybe that voltage for a time may be considered 50V across R1.
So now I proceed with 50V equated to the L1 and R2 branch.
Some plots to maybe catch my mistakes and error, continued following the plots.

Chapter 6 Part C. Solving Problems (Examples and Exercises). Source of study material: 1). Electric Circuits 6th Ed Schaums - Nahvi & Edminister. 2). Solutions & Problems of Control System - AK Jairath. 3). Engineering Circuits Analysis - Hyat & Kemmerly. My Homework. This is a pre-requisite study for Laplace Transforms in circuit analysis.
Karl S. Bogha.

clear (t) $v_C A(t) := -25 \cdot e^{-100\,t}$ $v_C B(t) := 25 - 25 \cdot e^{-1000\,t}$ <--- This equation.

$i1(t) := 0.05 - 0.05 \cdot e^{-100 \cdot t}$ $i2(t) := 2.5\, e^{-100\,t} - 2.5$ <--- Current waveform.





The current for C1 and L1 do not terminate at zero. Could that be a problem.
Discuss later.

Inductor Equation B:
(May be NOT suitable then see C next it does raise an odd situation in B):

$$vR2 + L1\left(\frac{di2}{dt}\right) = vR1 + 50\ V$$ For time t=infinity.

Since R1 = R2 can I cancel them off both sides?
Why Not? End condition maybe be when L1 is shorted. The current for t<infinity is not constant yet. There is the natural response. That is where the error is here maybe. Anyway I work it to see how the math again tries to steer my solution!

$$L1\left(\frac{di2}{dt}\right) = 50\ V$$ Here the time constant t<infinity will be -100.

$$L1\left(\frac{di2}{dt}\right) = 50\cdot\left(1 - e^{-100\cdot t}\right)$$ Voltage start at 50 stays constant thru t>>0. Exponential term for L1 initial and final conditions, forced response.

$$\left(\frac{di2}{dt}\right) = \frac{50\cdot\left(1 - e^{-100\cdot t}\right)}{L1} = \frac{50\cdot\left(1 - e^{-100\cdot t}\right)}{0.1} = 500\cdot\left(1 - e^{-100\cdot t}\right)$$

$$\left(\frac{di2(t)}{dt}\right) = 500\cdot\left(1 - e^{-100\cdot t}\right)$$

$$di2(t) = 500\cdot\left(1 - e^{-100\cdot t}\right)\ dt$$

Integrating both sides: $$\int_0^t i2(t)\,dt = \int_0^t 500\cdot\left(1 - e^{-100\cdot t}\right)\,dt$$

At time t=0, iL(0+) = iL(0) = 0. Therefore L1*i2(0) = 0.

$$i2(t) - i2(0) = i2(t) - 0 = i2(t) = \int_0^t 500\cdot\left(1 - e^{-100\cdot t}\right)\,dt$$

$$= 500\ t + \left(\frac{500}{-100}\right) e^{-100\ t}$$

$$= 500\ t - 5\ e^{-100\ t}$$

500t ? How do I see that workable?

The circuits current cannot increase substantially more than the voltage supply can provide, forced and natural combined, so the 500t term is neglected/discarded/dropped. Why at t=2 s for 500t, the current thru L1 = 500 x 2 = 1000 A. *Hello World !*

$$\lim_{t \to 0} \; i2(t) - i2(0) = i2(t) = -5\,e^{-100\,t} = -5\,e^{-100\,t} + 5\,e^{-100 \cdot 0} = -5\,e^{-100\,t} + 5$$

Lim t to t=0

$$i2(t) = -5\,e^{-100\,t} + 5$$ This a propsed steady state current.

Lets say I am somewhat agreeing to continue on with this. Because I was searching for a numerical value of 5. Answer driven!

Inductor Equation C (Maybe suitable) :

Voltage across the R2 and L1 branch :

$$R2 \cdot i2(t) + L1\left(\frac{di2(t)}{dt}\right) = v_{C1}(t) = 25 \cdot \left(1 - e^{-100\,t}\right)$$ C1 voltage, parallel branch.

$$L1\left(\frac{di2(t)}{dt}\right)$$ <--- The inductor is short circuited, voltage drop across it is zero.

$$R2(i2(t)) = 25 \cdot \left(1 - e^{-100\,t}\right)$$

$$i2(t) = \frac{25 \cdot \left(1 - e^{-100\,t}\right)}{5} = 5 \cdot \left(1 - e^{-100\,t}\right)$$

$$i2(t) = 5 - 5\,e^{-100\,t}$$

$$i2(t) = -5\,e^{-100\,t} + 5$$ This the steady state current. Maybe for now.

Short Talk:

I know this isnt the usual way you solved your problems, was not how I did mine either.

Some trial and error, some assumptions, some conditions,.......some continue on...

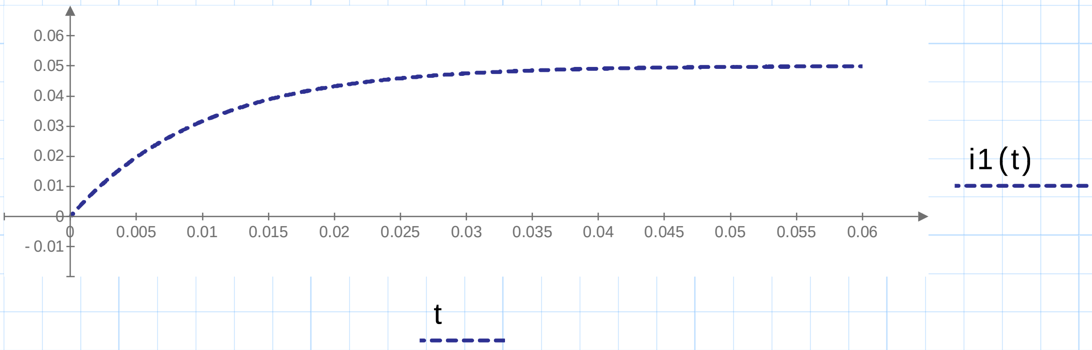
So inductor current using the C solution maybe more suitable. Fine.

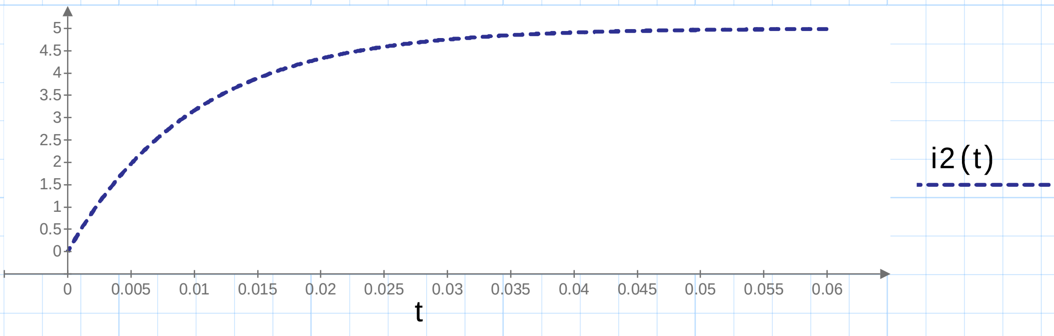
Same for me, its not the redicule side of things are not taken into consideration.

Oh thats rediculous! The competing business in the world do that all the time.
Here is one for the competition. Enjoy!

Next for a few plots.

clear (t) $i1(t) := 0.05 - 0.05 \cdot e^{-100 \cdot t}$ $i2(t) := -5\, e^{-100\, t} + 5$ <--- Current waveform.





Lets recap what I got. Both values do not settle to zero. Maybe helpful.
Steady state current.

$i1(t) = 0.05 - 0.05\left(e^{-100 \cdot t}\right)$ A.

$i2(t) = -5\, e^{-100\, t} + 5$ A.   Using C1 voltage branch as the voltage across the R2 and L1 branch.

$i2(t) = 2.5\, e^{-100\, t} - 2.5\, e^{-100\, 0} = 2.5\, e^{-100\, t} - 2.5$ A. Don't remember what this was
Reject this.

Steady state current for now:

$i1(t) = 0.05 - 0.05\left(e^{-100 \cdot t}\right)$

$i2(t) = -5\, e^{-100\, t} + 5$

Rearranging:

$i1(t) = -0.05\, e^{-100 \cdot t} + 0.05$

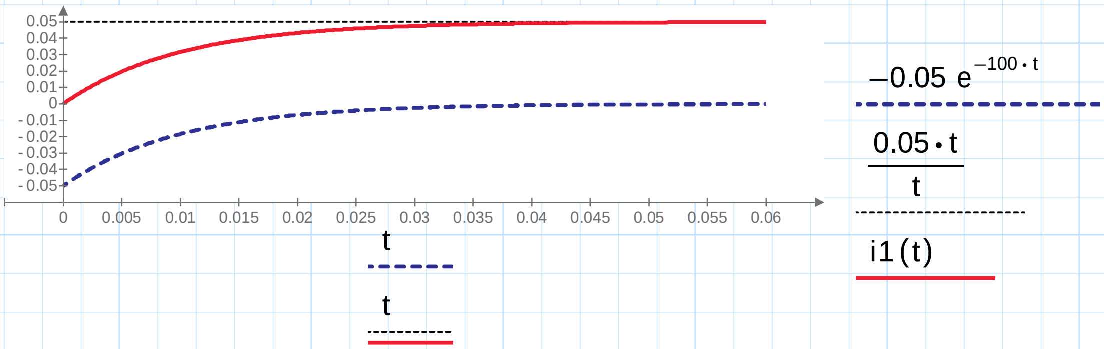
$i2(t) = -5\, e^{-100\, t} + 5$

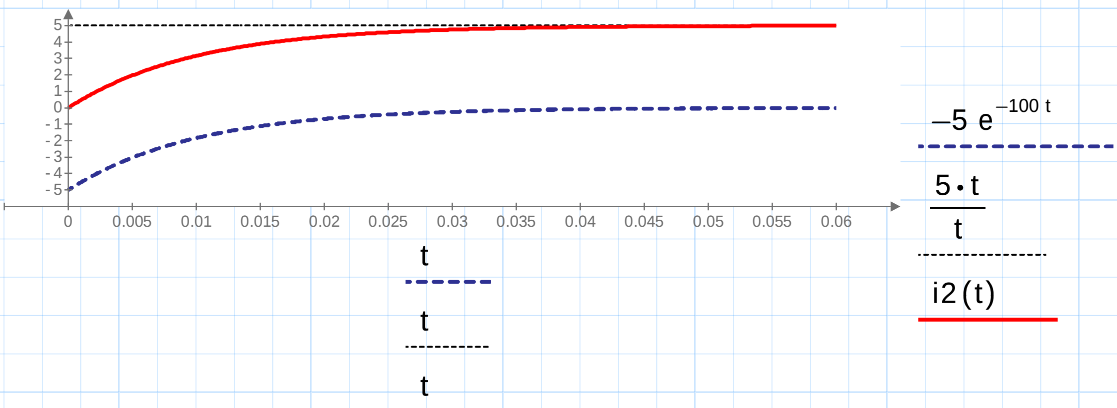
clear (t)

Plot: $i1(t) := -0.05\, e^{-100 \cdot t} + 0.05$

Plot: $i2(t) := -5\, e^{-100\, t} + 5$

Lets plot I may find something that reveal a thing or two I missed.





Both the curves are similar.
The constant values, 0.05 and 5, are misleading, what are they? Since L and C would have a gradually rising current from zero anyway, so what are these value? Thats the math assisting, so the final values rises up positive, and starts at zero.

$i1(t) = -0.05\, e^{-100 \cdot t} + 0.05$

The 0.05 constant term is not in the solution. *For now I say its a textbook error, whatever the cause, printing or intentional.*

$i2(t) = -5\, e^{-100\, t} + 5$

Instead of -5 its -5.05 for exponent term in textbook answer.

Continuing analysis for steady state condition, end condition:

Current from capacitor C1 in the end condition will discharge current into R2 and L1 branch, so the current for i2(t) steady state should include this. Add -0.05e^-100t

$$i2(t) = -5\,e^{-100\,t} + \left(-0.05\,e^{-100\cdot t}\right) + 5$$

$$i2(t) = -5.05\cdot e^{-100\,t} + 5$$

My steady state currents:

$$i1(t) = -0.05\,e^{-100\cdot t} + 0.05$$

$$i2(t) = -5.05\cdot e^{-100\,t} + 5$$

Textbook answers steady state currents:

$$i1(t) = -0.05\,e^{-100\cdot t}$$

$$i2(t) = -5.05\cdot e^{-100\,t} + 5$$

Except for the constant term of i1(t) that is 0.05 the answer is the same. Continuing with my solution, to complete this I need to get the transient currents for i1(t) and i2(t).

Next the transient response also called the natural response.
Here I remove the voltage source 50V. The flow of current is from the capacitor, it was fully charged and now discharges into the circuit. The time constant for steady state was 100, where t was considred equal infinity, next in transient state, the time constant will be 9950 where 0<t<infinity.

Since the current here must eventually die out for the natural response, I place the condition for iL(0+) = 0 since iL(0) = 0, and by inserting the exponential term. Here the time constant for 0<t<infinity will be -9950.

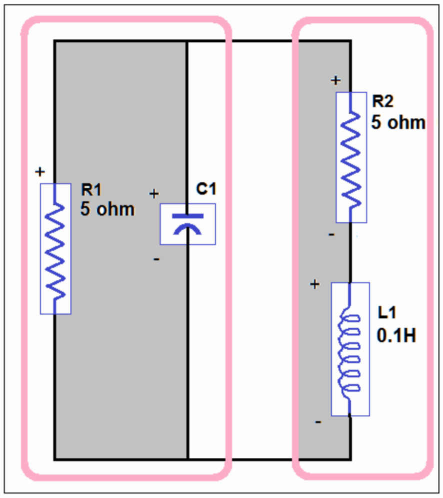
Natural response without the 50V in the circuit.

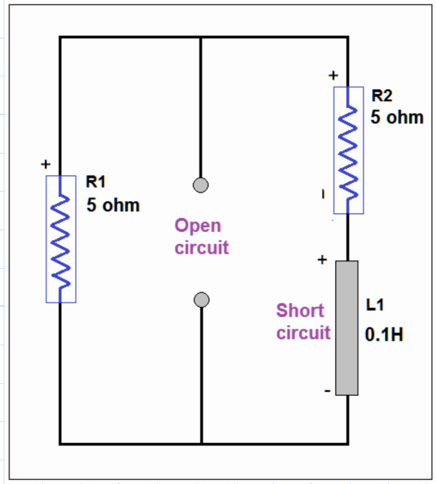
$$v_{C1}(t) = 25\cdot\left(1 - e^{-100\,t}\right)$$ Steady state at 25V, transient the exponential term.

$$i_C(t) := -0.05\,e^{-100\cdot t}$$ Transient term settles to zero for large t.

In either case, our experssion will have the exponential for i1(t) because its the RC side of the circuit. Current passing thru capacitor. So remove the thought that there will be a constant term. Eventually the current would die out with t>infinity, for the transient condition, without the V=50 supply for the capacitor. NOT the inductor that would have a constant 5A passing at thru when it is shorted. The inductor will have a exponential term for the 0<t<infinity, and at infinity it dies out.

Discussion To Force The Solution: Capacitor C1 and Inductor L1 are not operating in sync, one charges and discharges, the other energises and de-energise. So they impact each other with a net difference result. In Physics two body collision, momentum is added, situation here is they are not colliding, one lending +/- to the other and vice-versa. My thinking you probably got better idea. I may be in error for creating fake new properties and characteristics for the capacitor and inductor also known as fake engineering, don't get left out here either - Karl Bogha.

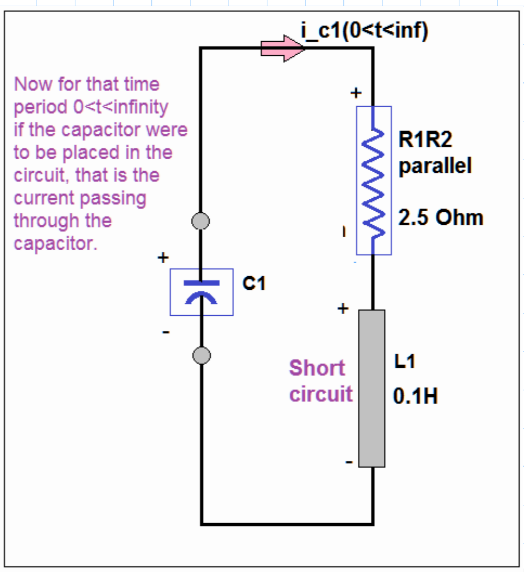




Two circuits side by side; RL and RC - figure to left. Do we work them together or individually for the 9950 time constant? Lets try individually first. Maybe the only way since I am not doing a voltage loop of current node.
The left side RC parallel can be seen as a current source when it dischages current.

$$\frac{1}{\tau_{Net}} = \frac{1}{\tau_{R1C1\_parallel}} - \frac{1}{\tau_{R2L1\_series}} = 10000 - 50 = 9950$$

The time constant applied here.



$$R_{paralel} := \frac{R1 \cdot R2}{R1 + R2} = 2.5$$

No external voltage source. Total resistance is the parallel resistance of R1 and R2.

Voltage across the branches is the voltage across the capacitor.

$$v_{C1}(0 < t < \infty) = 25 \cdot \left(1 - e^{-9950\,t}\right)$$

Time t of concern: $v_{C1}(0 < t < \infty)$

$$v_{C1}(0 < t < \infty) = -25\, e^{-9950\,t}$$

25V is removed because that is a constant value assisting at t=0, so that vC1(0) = 0. Removed it for 0<t<infinity.

When capacitor voltage is divided by the resistance, parallel resistance seen by C1, it gives the current discharged from C1.

$$i_1(o<t<\infty) = i_{C1}(0<t<\infty) = \frac{-25\,e^{-9950\,t}}{2.5} = -10\,e^{-9950\,t} = 10\,e^{-9950\,t} \text{ A.}$$

Sign on i1(t) = -0.05e(^-100t) is -ve, going from + to -ve of C1, this sign needs to be made positive for 0<t<inf. Why? Current is flowing out of C1's -ve to +ve into L1 and R2.

$$i_{C1}(t) = C1\cdot\frac{d\_v_{C1}}{dt} = -0.05\left(e^{-100\cdot t}\right) \text{ A.}$$

Now becomes +ve, and its included in the transient state because it is? time dependent, the exponential term has time t, from 0 to under infinity, 0<t<infinity, here current behaves in the exponential curve form for transient.
However, the time constant is 9950 instead of 100. This I showed in my discussion.

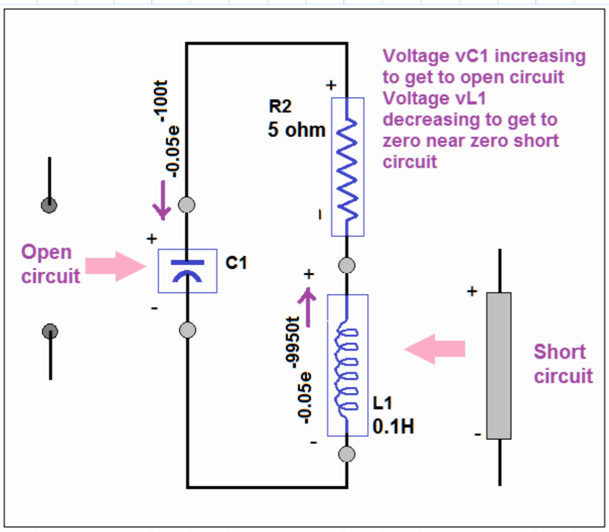
$$i_{C1}(t) = C1\cdot\frac{d\_v_{C1}}{dt} = 0.05\left(e^{-9950\cdot t}\right) \text{ A.}$$

This need to be added into the natural response. My solution conditon impacted twice in i1(t); once for dc and the other for transient. Exponential term is debatable!

$$i1_n(t) = 0.05\cdot e^{-9950\,t} + 10\,e^{-9950\,t} = 10.05\,e^{-9950\cdot t} \text{ A}$$

Natural response without voltage source.

In an earlier part of the solution current i1(t), was found a transient value of ic1(t), see figure below.



With the current going thru the inductor from the -ve to +ve terminal the sign of the current in the 9950 time constant is postive for inductor L1.

$$i2_n(t) = 0.05\left(e^{-9950\cdot t}\right) \text{ A.}$$

Next recap the transient values and plots.

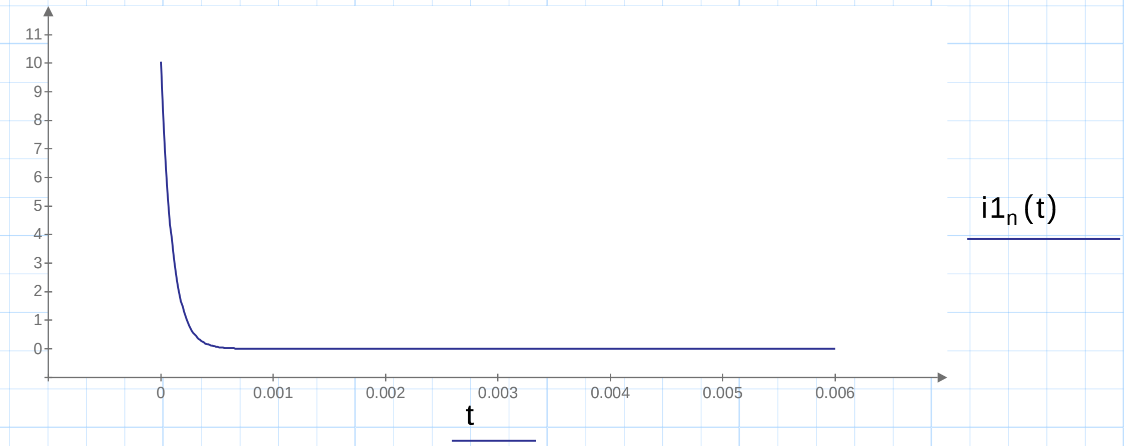
Recap natural response:

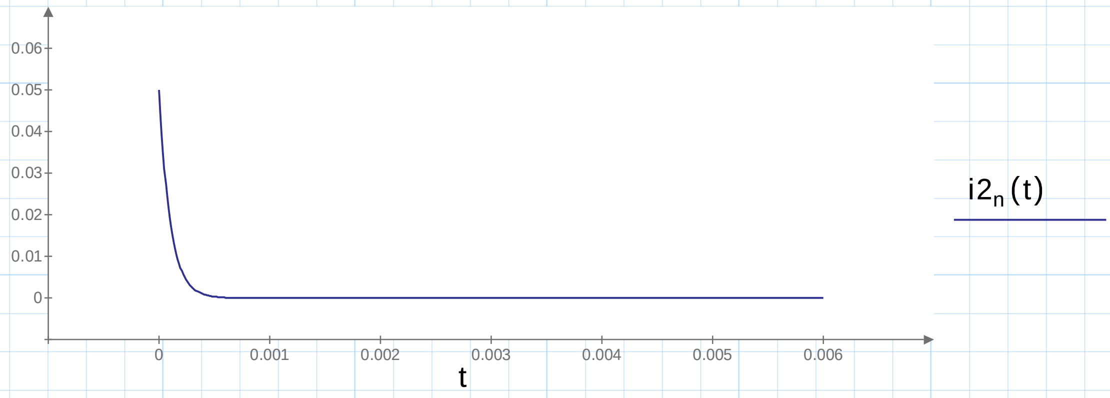
$i_1(o < t < \infty) = i_{C1}(0 < t < \infty) = \dfrac{-25\ e^{-9950\ t}}{2.5} = -10\ e^{-9950\ t} = 10\ e^{-9950\ t}$ A.

$i1_n(t) = 0.05 \cdot e^{-9950\ t} + 10\ e^{-9950\ t} = 10.05\ e^{-9950 \cdot t}$ A Total natural response without voltage source.

$i2_n(t) = 0.05\left(e^{-9950 \cdot t}\right)$ A. Natural response without voltage source.

clear (t) $i1_n(t) := 10.05\ e^{-9950 \cdot t}$ A. $i2_n(t) := 0.05\left(e^{-9950 \cdot t}\right)$ A.





Both i1n(t) and i2n(t) natural response dies out faster than previous forced responses. Here almost at same time. The time constant much higher 9950 so obviously the curve will be steeper and settles to zero faster. Settles to zero is required.

In my somewhat loose solution method now I have to set the final answer for the my complete solution.

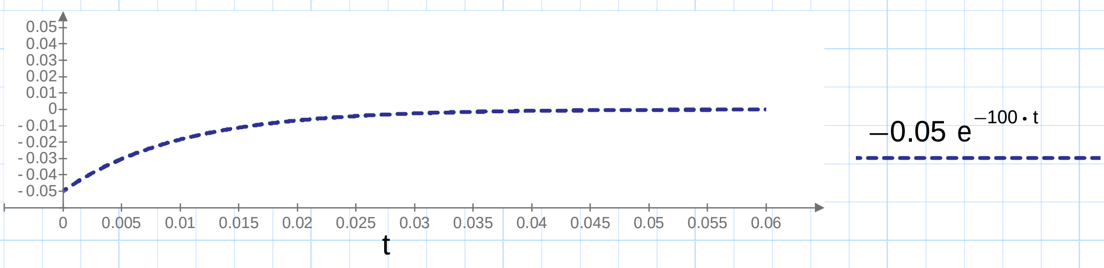
In the capacitor equation for i1(t) I came to this expression.

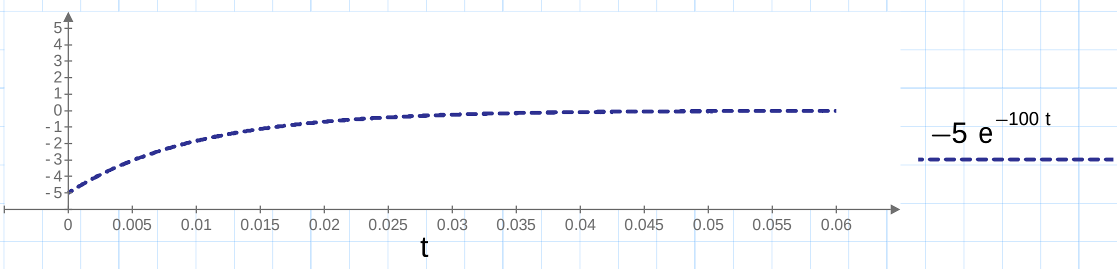
$$i_C(t) - 0 \quad = \quad i_{C1}(t) \quad = \quad i1(t) \quad = \quad 0.05 - 0.05\left(e^{-100 \cdot t}\right) \quad \text{A.}$$

This the steady state current.

$0.05 - 0.05\left(e^{-100 \cdot t}\right)$ For my solution I need to remove the 0.05 term, its a constant dc term. Does it have a place in the forced response condition for 0<t<infinity?

At t=0 this expression becomes 0. That satisfies an initial condition at t=0, but what for 0<t<infinity? Greater than t=0 would mean for the time t is NOT equal 0, for that I may remove 0.05 because it is there to satisfy the initial condition and also bring down all the current values by 0.05 for time t>0. Below the 2 plots I had previously without the other terms.





In section 7.3 of Schaums DC voltage across a capacitor, (Part 2 notes) the current expression was iC(t) = (Vo/R)e^-t/RC u(t). The u(t) condition for time t=0 and t>0. So in a RC circuit that two term expression with a constant value may not always apply as I see it for making work this solution. I maybe wrong here you check and discuss.

Both plots settle to 0, which should lend to the end condition with only 5A dc operating the circuit, C1 open circuit and L1 short circuit.

How does this end up with all the equation I have? Next page.

Also the dc condition was 5A. I dont need this 5A constant term in the expression -5e^-100t +5 A. Just so happens the result had a 5 in the expression, that added to the mix of things with the dc 5A already found. Or am I to say that 5 in the expression -5e^-100t +5 was the dc constant again? Not so. So some arguement is there you may say. Maybe my expression should been iC(t) = (Vo/R)e^-t/RC without 1 infront to start with and maybe the same explanation exists in there.

Forced response:

$i1(t) = -0.05\, e^{-100 \cdot t} + 0.05$ A. Remove 0.05

$i1_f(t) = -0.05\, e^{-100 \cdot t}$ A.

$i2(t) = -5.05 \cdot e^{-100\, t} + 5$ Remove 5, and ADD the dc t=infinity 5A. When C is open circuit and L short circuit.

$i2(t) = -5.05 \cdot e^{-100\, t}$ A.

$i2_f(t) = -5.05 \cdot e^{-100\, t} + 5$ A with dc 5A for t end condition.

Natural/Transient response:

$i1_n(t) = 10.05\, e^{-9950 \cdot t}$ A.

$i2_n(t) = 0.05\, \left(e^{-9950 \cdot t}\right)$ A.

Now for my make it work solution which may be wrong you verify with your lecturer and local enigneer.

$i1(t) = i1_f(t) + i1_n(t)$

$i1(t) = -0.05\, e^{-100 \cdot t} + 10.05\, e^{-9950 \cdot t}$ My Answer. Match the textbook. You verify.

$i2(t) = i2_f(t) + i2_n(t)$

$i2(t) = -5.05 \cdot e^{-100\, t} + 5 + 0.05\, \left(e^{-9950 \cdot t}\right)$ My Answer. Match the textbook. You verify.

Textbook answers: $i1(t) = -0.05\, e^{-100 \cdot t} + 10.05\, e^{-9950 \cdot t}$

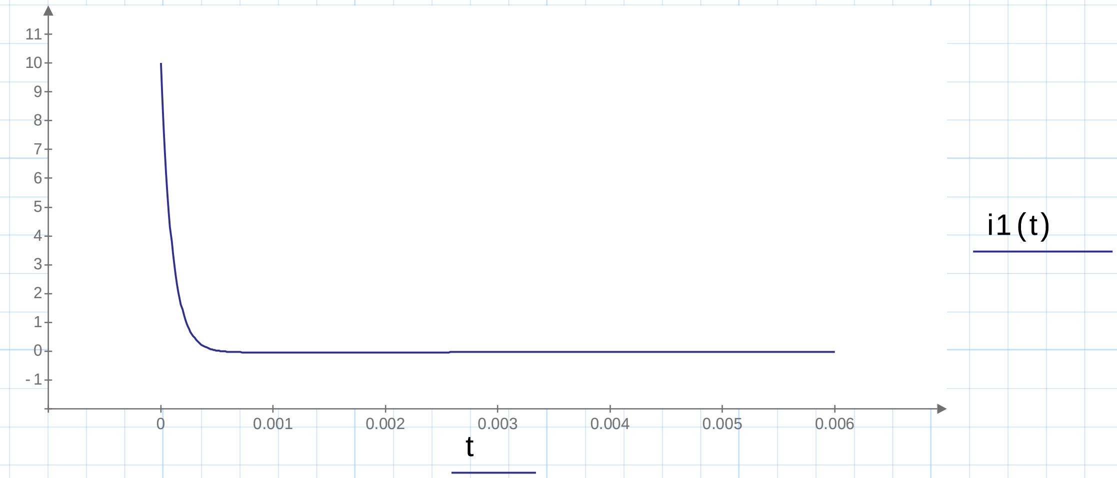
$i2(t) = -5.05 \cdot e^{-100\, t} + 5 + 0.05\, \left(e^{-9950 \cdot t}\right)$

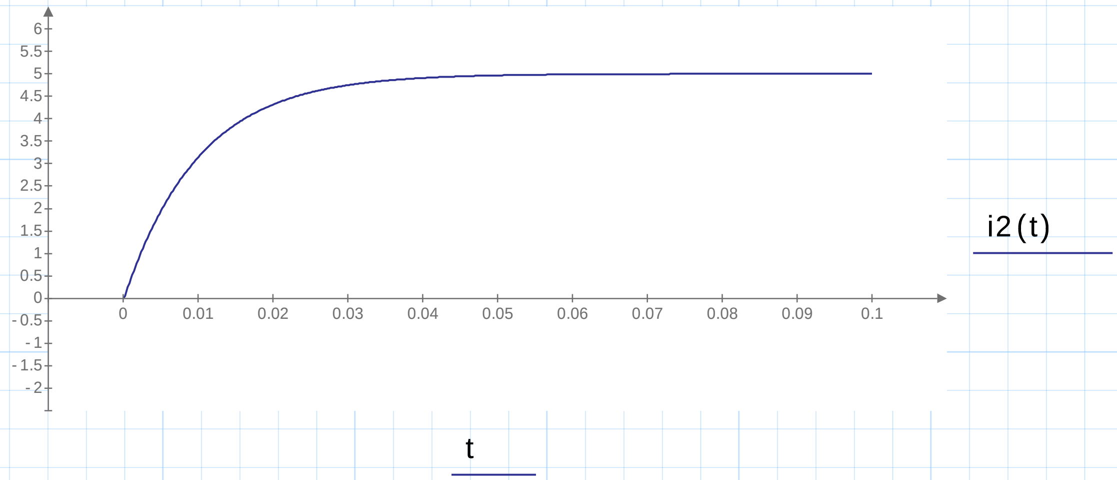
Plots for the final current expressions :

clear (t)

$$i1(t) := -0.05 \cdot e^{-100 \cdot t} + 10.05 \cdot e^{-9950 \cdot t}$$

$$i2(t) := -5.05 \cdot e^{-100\ t} + 5 + 0.05 \cdot \left(e^{-9950 \cdot t}\right)$$





Plot discussion:

i1(t) settles to zero since this is where the capacitor C1 open circuit.
i2(t) continues with 5A here the inductor is short circuit.
Both currents do not start at zero.
i1(t) starts at 10.05A, then drops to zero. This is where capacitor charged up to and a current of 10.05 A is seen, and then capacitor discharges current into the circuit to 0A.
The inductor branch is the dc circuit here the current builds up from 0A by the voltage source and remains steady state at 5A.

Many errors and omissions are apologised in advance.