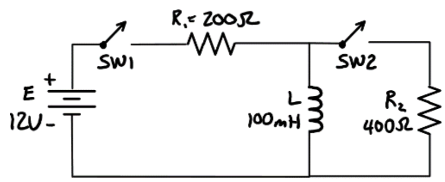
Inductor Release Process (59:32)

Discuss the electrical properties of an inductor storage circuit beyond 5 time constants.

Write the formula used to calculate the amount of energy stored in an inductor.

Calculate the energy stored in a 100mH inductor carrying 60mA of current.

Inductor Release Circuit 1 (4:05 to 18:33)



A previous storage process through SW1 has established 60mA of current through the inductor. At t=0 SW1 opens SW2 instantly and simultaneously closes.

Describe the release process in general terms. Discuss the significance of voltage polarity with regard to instrumentation.

Draw a general purpose plot of voltage across an inductor as a function of time for a simple inductor release process and identify an equation that describes this phenomenon. Discuss the significance of negation.

Draw a general purpose plot of current through an inductor as a function of time for a simple inductor storage process and identify an equation that describes this phenomenon.

Identify the 3 data points necessary to perform the transient analysis of the inductor release process.

Identify the start and end current for a complete inductor release process. Determine these values for inductor release circuit 1.

Identify the magnitude of the initial voltage surge for inductor release circuit 1. Identify the end voltage for a complete release.

Determine the time constant for inductor release circuit 1. Determine the length of a complete release.

Derive the time variant expressions for $v_L(t)$ and $i_L(t)$ for inductor release circuit 1 and plot these properties for a full release.

Derive the time variant expressions for $v_{R2}(t)$ and $i_{R2}(t)$ for inductor release circuit 1 and plot these properties for a release. Assume the following: positive I_2 travels in to out bottom to top, positive V_2 appears positive to negative bottom to top

Determine the instantaneous values for I_L, V_L, I_2, and V_2 at t=200µs.

Determine the time I_L has dropped to 50mA. At this same time solve for instantaneous values for V_L, I_2, and V_2.

Using data obtained for inductor storage circuit 1 in the “Inductor Storage Process” lecture, plot a back to back storage and release sequence for all elements in the system given the following conditions:
t=0 to 2.5ms, SW1 closed, SW2 open
t=2.5 to 3.75ms, SW1 open, SW2 closed

Describe the general behavior of electrical properties for a back to back inductor storage and release process.

Comment on the asymmetric nature of the storage and release process.

Comment how time values obtained during an analysis of an isolated release process must be referenced for a back to back storage and release process.

Determine the time release current has dropped to 27mA for a back to back storage and release process.

Discuss the implications of release paths with extremely low resistance.

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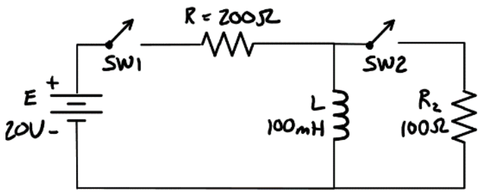
Inductor Release Circuit 2 (23:44 to 36:59)



A previous 500μs partial storage process with initial conditions (t=0 I_L=60mA) through SW1 has established 85.3mA of current through the inductor. At t=500μs SW1 opens SW2 instantly and simultaneously closes for a 500us partial release.

Determine the time constant for inductor release circuit 1. Determine the length of a complete release.

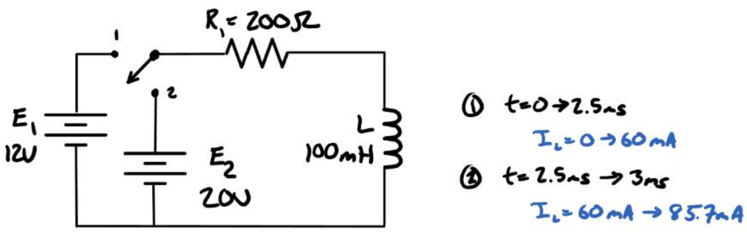
Derive the time variant expressions for $v_L(t)$, $i_L(t)$, $v_{R2}(t)$ and $i_{R2}(t)$ for inductor release circuit 2.

Determine the instantaneous values for I_L, V_L, I_2, and V_2 at the end of a 500μs partial release (ie: the larger timeline's t=1ms).

Using data obtained for inductor storage circuit 2 in the "Inductor Storage Process" lecture, plot a back to back partial storage and partial release sequence with initial conditions (t=0 I_L=60mA) for all elements in the system given the following conditions:
t= 0 to 500μs, SW1 closed, SW2 open
t= 500μs to 1ms, SW1 open, SW2 closed

If this system conducted repeated back to back partial storage and partial release events identify the beginning state of each next stage.

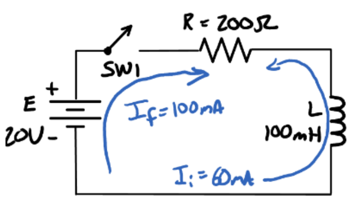
Inductor Release Circuit 2 Modification 1 (36:59 to 43:00)



Derive and plot the electrical properties of this system if the switch moved back to position 1 at t=3ms.

Describe what the release of the energy stored in the inductor allows the system to momentarily do.

Inductor Release Circuit 2 Modification 2 (43:00 to 50:00)

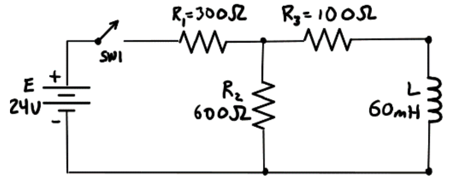


Derive and plot the electrical properties of this system if initial current (60mA) was traveling through the inductor in the opposite direction of final current (100mA).

Describe what the release of energy stored in the inductor allows the system to momentarily do.

Determine the conditions that signify the end of the release and the beginning of storage in the other direction. Determine the length of the release process and subsequent storage.

Inductor Release Circuit 3 (50:00 to END)



A previous storage process through SW1 has established 53.3mA of current through the inductor. At t=1ms SW1 opens for release.

Determine the time constant for inductor release circuit 3. Determine the length of a complete release.

Derive the time variant expressions for $v_L(t)$ and $i_L(t)$ for inductor release circuit 3.

Determine the instantaneous values for I_L, V_L, I_2, and V_2 at the end of a 500µs partial release (ie: the larger timeline's t=1ms).

Using data obtained for inductor storage circuit 3 in the "Inductor Storage Process" lecture, plot a back to back storage and release sequence for the inductor given the following conditions:
t= 0 to 1ms, SW1 closed
t= 1ms to 1.4286ms, SW1 opened