Lab 3: Inductors and Time-Dependent Signals

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1   Time dependent analysis of RL Circuits

The resistance is $997\,\Omega$ and the inductance is $21.4\,\text{mH}$
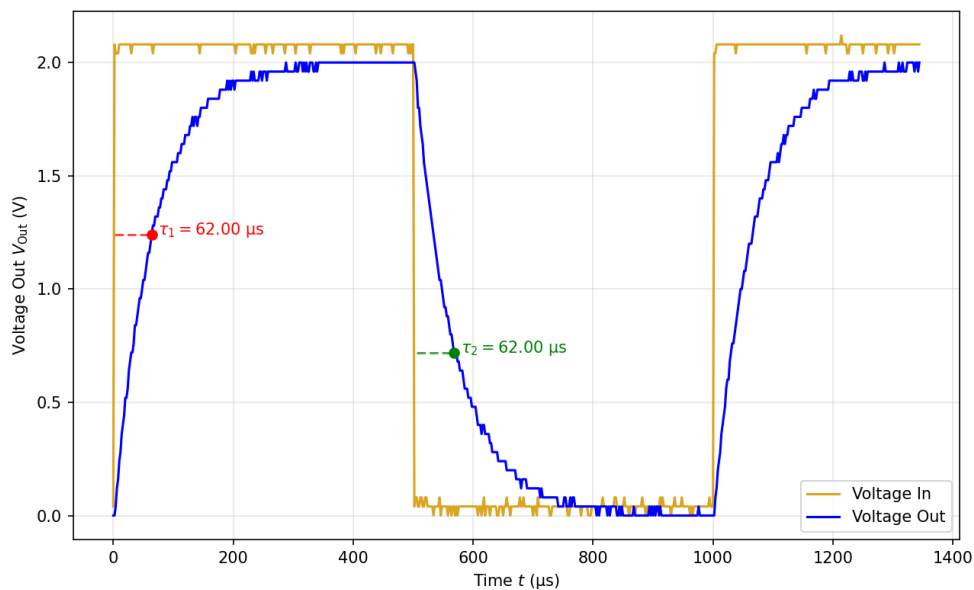

Figure 1: Measurement of time constact $\tau = RC$ by determining the time for the output to drop to $1/e$ of the maximum (in green)and to rise to $1 - (1/e)$ of the maximum (in red). Both values are equal to $\tau = 62\,\mu\text{s}$.

2 The RC Integrator (Low-Pass Filter)

- Use the circuit of Part 1 and apply a 20 kHz square-wave signal.

    - Explain how the observed waveform is consistent with the concept of an RC circuit behaving as an integrator.

    - Over what frequency range does the circuit behave as an integrator, that is, is capable of producing a triangle-wave output from a square-wave input? Explain why this circuit is also known as a low-pass filter.

3   The CR Differentiator (High-Pass Filter)

- Explain how the observed waveform is consistent with the concept of an CR circuit behaving as an differentiator.

   - Vary the frequency of the square wave input from 1 Hz to 1 MHz and describe the behavior of this circuit. Does it ever appear to behave as an integrator or a differentiator? Explain why this circuit is also known as a high-pass filter.

4 Frequency response of both low-pass and high-pass filters