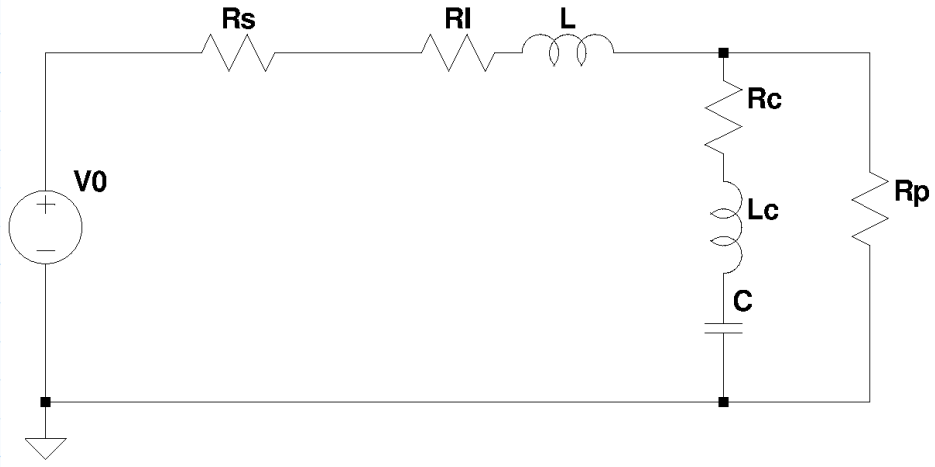
RLC step response

Design Parameters

Enter here the design parameters and component values

Input voltage	$V_0 := 350\ V$
Series resistance	$R_S := 0\ \Omega$
Parallel resistance	$R_P := 1\ M\Omega$
Inductor value and ESR	$L := 100\ \mu H$ $R_L := 0.1\ \Omega$
Capacitor value, ESR and ESL	$C := 440\ \mu F$ $R_C := 0.3\ \Omega$ $L_C := 0.1\ \mu H$
Plot time	$T_{max} := 10\ ms$
Plot points	$N := 10000$



RLC step response

$$t := 0\ s, \frac{T_{max}}{N} .. T_{max}$$

ConstraintsGuess Values

$$I(0) = 0\ A \qquad V(0) = 0\ V$$

$$V_C(0) = 0\ V \qquad I_C(0) = 0\ A$$

$$I'(t) = \frac{1}{L} \cdot \left(V_0 - \left(R_L + R_S\right) \cdot I(t) - V(t)\right)$$

$$V_C'(t) = \frac{1}{C} \cdot I_C(t)$$

$$V(t) = V_C(t) + R_C \cdot I_C(t) + L_C \cdot I_C'(t)$$

$$I(t) = I_C(t) + \frac{V(t)}{R_P}$$

Solver

$$\begin{bmatrix} I \\ V_C \\ V \\ I_C \end{bmatrix} := \text{odesolve}\left(\begin{bmatrix} I(t) \\ V_C(t) \\ V(t) \\ I_C(t) \end{bmatrix}, T_{max}\right)$$

$$I_{max} := \left\| \begin{array}{l} M \leftarrow 0\ A \\ \text{for } n \in 0..N \\ \quad \left\| \begin{array}{l} \text{if } I\left(n \cdot \frac{T_{max}}{N}\right) > M \\ \quad \left\| M \leftarrow I\left(n \cdot \frac{T_{max}}{N}\right) \right. \end{array} \right. \\ M \end{array} \right\| = 433.793\ A$$

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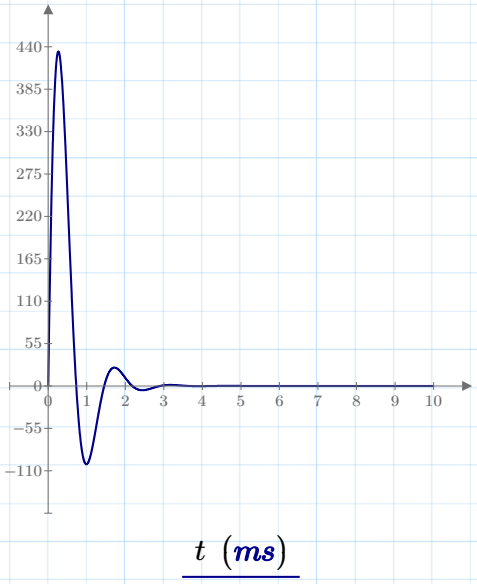
$$V_{max} := \left\| \begin{array}{l} M \leftarrow 0\ V \\ \text{for } n \in 0..N \\ \quad \left\| \begin{array}{l} \text{if } V\left(n \cdot \frac{T_{max}}{N}\right) > M \\ \quad \left\| M \leftarrow V\left(n \cdot \frac{T_{max}}{N}\right) \right\| \end{array} \right\| \\ M \end{array} \right\| = 453.515\ V$$

Peak values and plots

The following parameters are calculated from the previous ones. Do not edit them.

Maximum current in the inductor $I_{max} = 433.8\ A$

Maximum voltage on the capacitor $V_{max} = 453.5\ V$



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