ELECTRONICS (I)

ASSIGNMENT #1 : BASIC ELECTRIC CIRCUITS

Consider the following RLC circuit with no initial charge in the capacitor and no initial current through the inductor:

Try to produce the following results using the techniques presented in the lectures:

1. Its system equation (a differential-integral equation) in time domain based on Kirchhoff’s Voltage and Current Laws 20 points
2. Its system equation (an algebraic equation) in Laplace domain using the concept of impedance 15 points
3. The algebraic expression of its transfer function $H(s)$ in Laplace domain 10 points
4. The algebraic expressions of its poles $\{s_p\}$ and zeros $\{s_z\}$ in Laplace domain 15 points

For answering the following questions, let $C = 1\text{nF}$ or $10^{-9}\text{F}$, $L = 1\text{mH}$ or $10^{-3}\text{H}$ and the resistance $R$ take four different values: $500\text{K}\Omega$, $5\text{K}\Omega$, $500\text{Ω}$ and $50\text{Ω}$.

5. Plot the positions of poles and zeros of the circuit with these component values 10 points
6. Produce using a graphic software¹ or by hand the Bodé Plots of the magnitude $|H(\omega)|$ and the phase $\angle H(\omega)$ of its transfer function in the frequency domain when the components have the prescribed values 20 points
7. Comments on the frequency response of the circuit as it goes from over damped through critically damped to under damped conditions as the resistor changes its values 10 points

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¹ You may use P-SPICE, SigmaPlot, MathCAD or any other software to produce the Bodé Plots.