

ELECTRIC CIRCUITS

ECSE-2010

Lecture 16

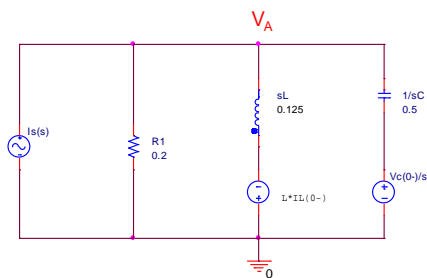


REVIEW: CIRCUITS WITH LAPLACE

1. Find Initial Conditions
2. Determine Laplace Equivalent circuit
3. Use Unit 1 concepts (node/mesh/voltage dividers etc.) to find an expression for the parameter of interest (impedances)
 - a. "Clean up" expression to have $\frac{N(s)}{D(s)}$
4. Find poles (zeros, Unit 3)
5. Partial fraction expansion
 - a. Cover up rule for coefficients or $F(0)$, $F(1)$
6. Inverse Laplace gives time domain response



REVIEW S-DOMAIN



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S-DOMAIN CIRCUIT ANALYSIS

- Review S-domain conversion
- Circuit Theorems (Unit 1) in the S-Domain
 - KCL/KVL
 - Superposition
 - Thevenin/Norton
 - Node Analysis

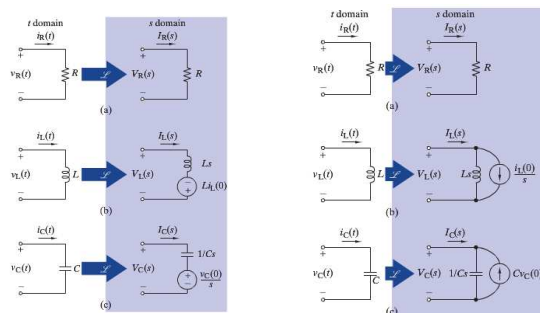


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S-DOMAIN CONVERSION

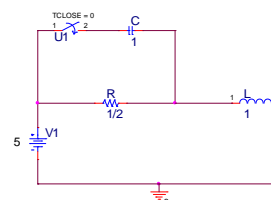


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KCL/KVL



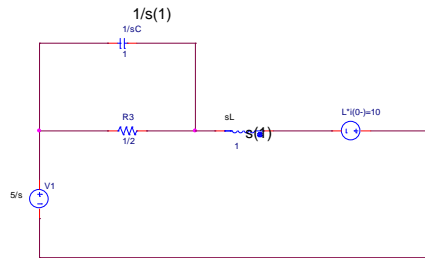
In the above circuit, a 5V DC source is shown. At $t = 0$, the switch in series with the capacitor is closed.

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KCL/KVL

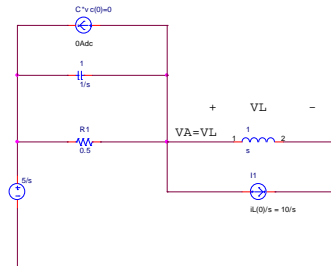


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KCL/KVL



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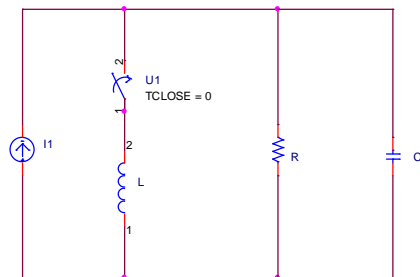


SUPERPOSITION

- Two types of independent sources
 - Voltage and current representing external driving forces for $t \geq 0$
 - Initial condition voltage and current sources representing energy stored at $t=0$.
- S-domain response is the sum of two components
 - Zero input response (initial condition sources with external inputs turned off)
 - Zero state response (external inputs with the initial condition sources turned off).



SUPERPOSITION: ZERO INPUT, ZERO STATE

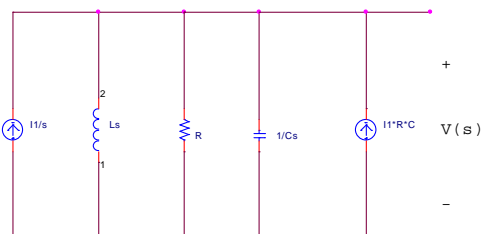


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SUPERPOSITION: ZERO INPUT, ZERO STATE

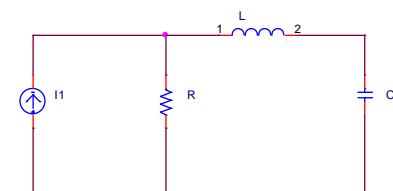


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NODAL ANALYSIS

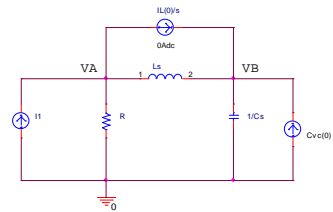


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NODAL ANALYSIS

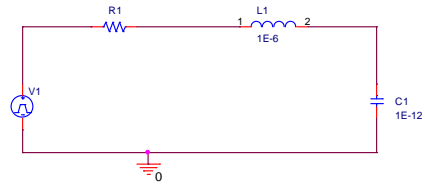


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S-DOMAIN W/INITIAL CONDITIONS

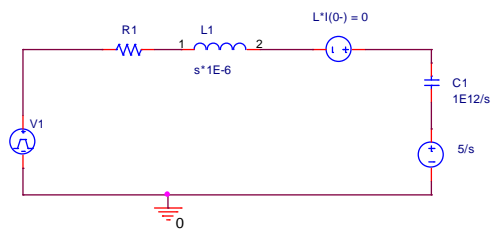


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S-DOMAIN W/INITIAL CONDITIONS



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