Explanation until 14:50

Code example 16:49 - 24:35

Electric Networks: Computer Aided Analysis and Simulation

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Problem Sheet 5 December 2020

Given is the circuit in figure 1 with the following parameters: $v_\mathrm{S} = 230\,\mathrm{kV}\cos(2\pi\,60\,\mathrm{Hz}\,t)$, $G_1 = 1\,\mathrm{S}$, $G_2 = 0.01\,\mathrm{S}$, $L = 10\,\mathrm{mH}$, $C = 10\,\mu\mathrm{F}$.

Steps:

1. Simulate resistance first (No transient)
2. Save & copy
3. Include the inductors
4. Save & copy
5. Include the capacitors

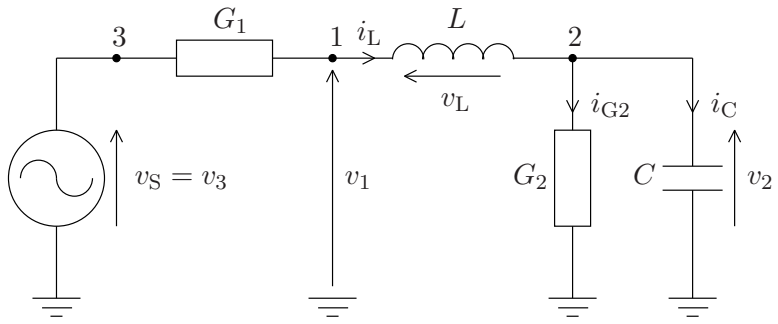

Figure 1

a) **8 points** Write and describe a MATLAB program which calculates the instantaneous values of the dependent nodal voltages v_1 and v_2, the inductor current i_L and the capacitor current i_C for $t = 0\,\mathrm{s}$. For the purpose of the calculation, it is assumed that the voltage source has been switched on a long time ago, i. e. it is assumed that the steady state is reached at $t = 0\,\mathrm{s}$. The use of nodal analysis techniques and complex variable representation is recommended for the calculations. The instantaneous values can be obtained as the real parts of the complex variables. Give the results of the calculations.

b) **15 points** Write and describe a MATLAB program which simulates the electromagnetic transients of this circuit. For the construction of the network model, implement the rules discussed in section 4.1.2 of the lecture notes. In the first time step, the simulation is initialized with the results from a). Check if the program works by plotting selected results.

c) **4 points** Do the simulations of b) again, but this time initialize for $t = 0\,\mathrm{s}$: $v_2(0\,\mathrm{s}) = 0\,\mathrm{V}$, $i_\mathrm{L}(0\,\mathrm{s}) = 0\,\mathrm{A}$. Discuss the results and the differences to those obtained in b).

```
t = 0;
v2_0 = 0;
i_L_0 = 0;
```

Hints: