ELEN 118
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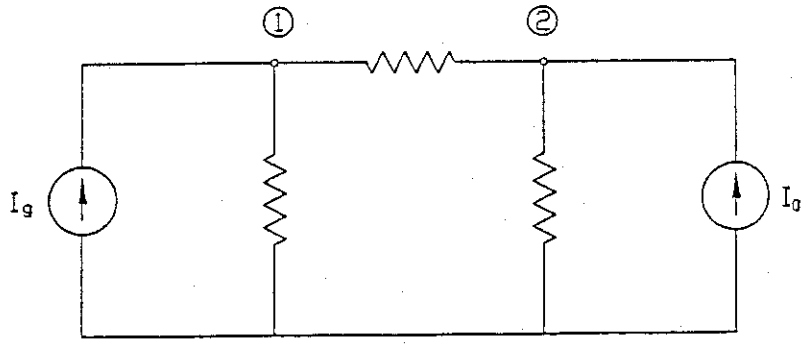
HOMEWORK # 4

PROBLEM 1. In the circuit below



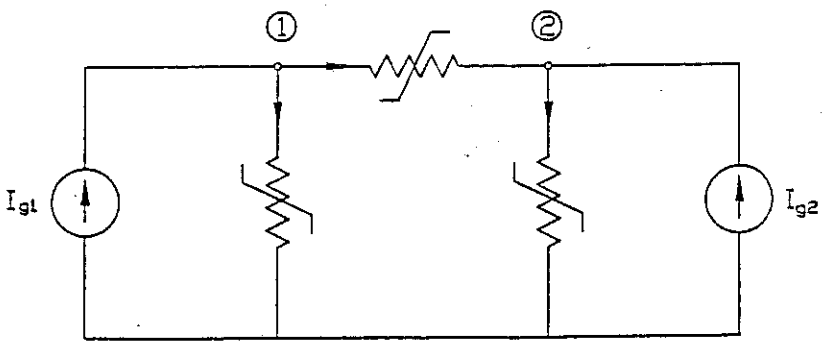
all three resistors have a 1Ω resistance, and I_g is a constant current source with I_g = 1A. The other source, I_0, is *nonlinear* and is defined by $I_0 = V_1^2$.

a) Formulate the DC equations for this circuit using element stamps.

b) Form the Jacobian for Newton's method.

c) Solve the equations given the initial guess: $V_1(0) = V_2(0) = 0$.

PROBLEM 2. The circuit below



contains three *nonlinear* resistors, all of which are defined by $i = g(v) \equiv v^2$. Current sources I_{g1} and I_{g2} are constant, with I_{g1} = 6A and I_{g2} = 4A.

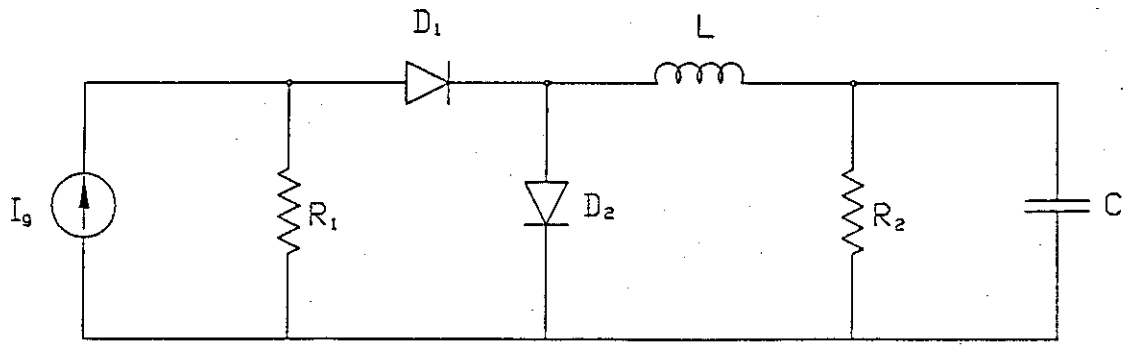
a) Formulate the DC equations for this circuit using element stamps.

b) Form the Jacobian for Newton's method.

c) Solve the equations given the initial guess: $V_1(0) = 0$ and $V_2(0) = 1$.

d) Does it make sense to take $V_1(0) = 0$ and $V_2(0) = 0$ as the initial guess in this problem? Explain.

PROBLEM 3. In the circuit below



you are given: $R_1 = 1K$; $R_2 = 700\Omega$; $L = 10$ mH; $C = 1\mu F$ and $I_g = 1.5$ mA. The two diodes are identical, with $I_S = 10^{-14}$ A.

a) Formulate the DC equations for this circuit using element stamps.

b) Form the Jacobian for Newton's method.

c) Determine a good initial guess for the voltages in this circuit. Explain your reasoning.

d) Using the initial guess obtained in part c), compute the *exact* DC solution using Newton's method.

PROBLEM 4. Repeat parts c) and d) of Problem 3 using the following element values: $R_1 = 2K$; $R_2 = 2K$; $L = 10$ mH; $C = 1\mu F$; $I_g = 2$ mA and $I_S = 10^{-14}$ A.