ECSE597
Assignment #1

In order to simplify parsing, we will use our own netlist format in ECSE59. For example consider the following netlist.

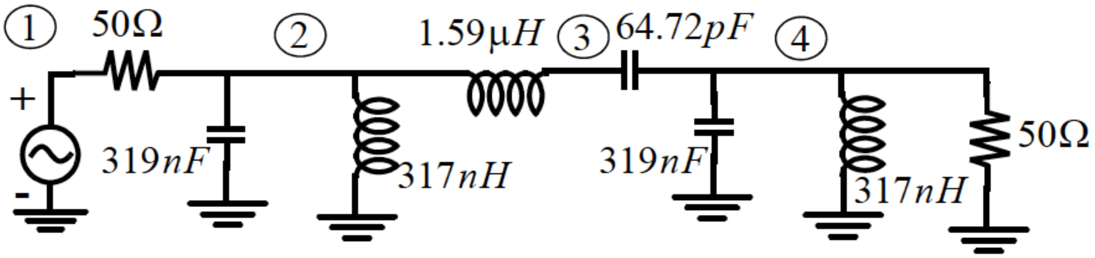
```
% CIR1.M
% Description of Circuit 1
% Author: R. K.
% Comment lines start with % just like in matlab (this is in fact a matlab
% script).

global G C %define global variables
global b;

G = zeros(4,4); % Define G, 4 node circuit (do not include additional
variables)
C = zeros(4,4); % Define C, 4 node circuit (do not include additional
variables)
b = zeros(4,1); % Define b, 4 node circuit (do not include additional
variables)
% Try changing zeros(4,4) with sparse(4,4) for sparse routines.
% See matlab help for info about sparse matrix support.


vol(1,0,1); % add voltage source between nodes 0 and 1 (value =1)
res(1,2,50); % add 50 ohm resistor between nodes 1 and 2
res(4,0,50);
cap(2,0,0.319e-6);
cap(3,4,64.72e-12);
cap(4,0,0.319e-6);
ind(2,0,0.317e-6);
ind(2,3,1.59e-6);
ind(4,0,0.317e-6);
```

The above netlist corresponds to the following circuit which has 4 nodes.



You will find on myCourses the following functions: cap.m, res.m, cur.m, vol.m, and diode.m which allow you to generate the MNA equations for circuits containing capacitors, resistors, current sources, voltage sources and diodes. You will also find the function f_vector.m which computes the nonlinear vector of the MNA, f(x), as a function of x. The file Circuit_diodeckt1.m is the netlist of a simple diode circuit. nlJacobian.m and dcsolve.m are the definitions of functions that you will need to write. Finally, Test_bench_diode1.m is the test bench that you should be able to run once you complete the assignment.

Questions:

1. Draw the circuit in the netlist Circuit_diodeckt1.m.
2. Write a matlab function nlJacobian.m (see function definition provided). This function should compute and return the Jacobian of the nonlinear vector f(x)
3. Write a matlab function dcsolve.m (see function definition provided). This function should use the Newton-Raphson method to compute the dc solution. It should also return the interim values of detlaX for each iteration (see function definition for details).
4. Run the script Test_bench_diode1.m to test your code for dcsolve.m.
5. Write the following matlab functions:

ind.m → adds an inductor to the MNA equations
vcvs.m → adds a voltage controlled voltage source to the MNA equations
vccs.m → adds a voltage controlled current source to the MNA equations
fsolve.m → performs a frequency domain analysis to obtain the frequency response.

See the attached matlab files with the same names for more precise definitions of these functions.

6. Run all Benchmark functions provided in order to test your simulator.

Deliverables:

1. A pdf file containing a) the schematic of the circuit in Circuit_diodeckt1.m, b) dc values computed after running test bench, c) the figure that was plotted when you ran the test bench, and d) the matlab code for nlJacobian.m and dcsolve.m.

2. The matlab m files for nlJacobian.m and dcsolve.m
3. A pdf file containing the results of all benchmark functions (all plots), as well as the matlab code for the functions your have written.
4. The matlab m files for ind.m, vcvs.m, vccs.m, fsolve.m