ECE 521 Fall 2016

Homework #1 - Part 2 Programming Assignment (Due Oct. 12)

1. This is the starting point for a simple circuit simulator, ***myspice***, that each of you will build. First we address the reading in (**readin**) of a circuit and the setup of the circuit matrix. For this assignment you are required to write the software to stamp the E (VCVS), F (CCCS), and H (CCVS) elements. Test examples are provided as test[1-7].ckt. As you progress with this course it will be your responsibility to add C, L, D, Q, and M elements. C-source code templates are provided that show how R, I, V, and G elements are readin and stamped. Readin code is provided for the other elements. The syntax used for the simulator is as follows

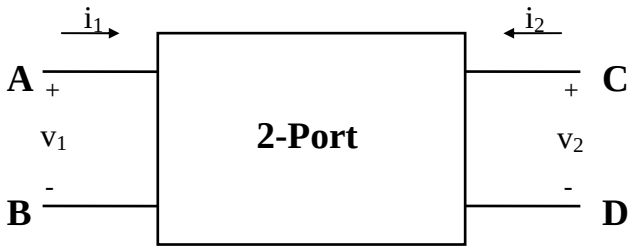
Rname	node	node	value			
Iname	node	node	value			
Vname	node	node	value			
Gname	node	node	node	node	value	
Ename	node	node	node	node	value	
Fname	node	node	vsrc	value		
Hname	node	node	vsrc	value		
Cname	node	node	value			
Lname	node	node	value			
Dname	node	node	model	value	<value refers to area factor>	
Qname	node	node	node	model	value	<value refers to area factor>
Mname	node	node	node	node	model value value	<the two value fields are the W and L of the MOSFET, respectively>

where *node* are node names (integers or strings), *value* is a floating-point number, *vsrc* is the name of a voltage source whose current is used as a controlling variable for current controlled sources, and *model* is the name of the model associated with a semiconductor device.

a) Add the code to stamp the E, F, and H elements in the circuit matrix. The circuit matrix is allocated as a dense matrix of size equal to the number of equations + 1. The *Setup<Element>* and *Stamp<Element>* functions should be developed to stamp the contributions for each element. Print the circuit matrices for test cases test[1-7].ckt using the *printMatrix* function. Note that the branch currents are added after the node numbers.

b) Suggest one way to verify that your stamps are correct.

c) Implement the **readin**, **print**, **setup**, and **stamp** functions of the following two-port descriptions. Your input syntax should be as shown with the definition of the two ports.



1. An ideal transformer (*n* is the transformer turns ratio):

   Nname node node node node n<value>

$$v_1 = nv_2$$
$$i_1 = -\frac{1}{n} i_2$$

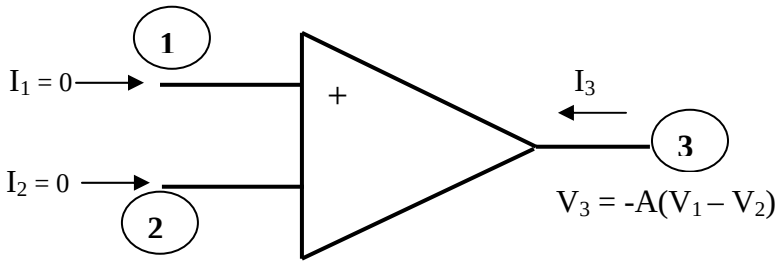
2. An ideal gyrator (*g* is the gyration constant)

   Tname node node node node g<value>

$$i_1 = -gv_2$$
$$i_2 = gv_1$$

d) Implement the **readin**, **print**, and **stamp** functions for an ideal opamp. The terminal characteristics are described below.

Oname node node node A



e) Provide a test circuit input file for each element in (c) and (d) similar to the test[1-7].ckt files provided for the other example. Name these files testn.ckt, testt.ckt, and testo.ckt. You need to print the circuit matrices for each of these test cases.

f) How have you verified that the circuit matrices in (e) are correct?

g) List at least four error checks that must be performed during readin.