

SPICE simulation in Python

This program has been made to solve circuits given in a certain(spice) format.

Approach

I am first making the matrix and then using “gausselim” function to solve this. I am making the matrix row wise == nodal analysis at each node. So for, say, n nodes, we will have n nodal equations and n2 equations for the Vsources.

Functions:

- `eval_spice`: This function opens the input file, if valid, and converts the list to a standardized list for further functions to work. Further this is also the main function which calls all the other functions and produces the final result matrix.
- `nodal_anal`: This function is a major function for the logic implemented. It takes in the standardized input file and outputs an equation for the specified node.
- `v_equation`: This function completes the matrix and adds the voltage source equations.
- `b_out`: This function gives the constants matrix
- `gauss_elim`: This function solves the matrix and gives errors in case of invalid matrix.
- `unknown_counter`: This function basically counts the number of unique nodes.

Errors resolved (given):

- `FileNotFoundError` (Wrong file name)
- No Solution - This error rises when the matrix sent to `gauss_elim` is singular, which means the circuit has no solution.
- If `.circuit` or `.end` not found in file (Malformed Error)
- If any circuit element except R,V,I is given then it gives an invalid element error.

Errors resolved (extra):

- If negative resistor is given then a “malformed circuit” error is raised.
- If resistance = 0 then I have taken $1/R$ to be 10^{10} so that the other resistances are not ignored
- If the same element has been added twice then we give malformed circuit error.

- If the Vsource or Isource is given to be ac then an error “Malformed circuit file” is raised. `##` Problems with the code:

The input must have a specific format. The nodes can be named of the form n1,n2,n3 or 1,2,3. Similarly, the Vsource and Isource can be of the form “Vsource”, “V1” and “Isource”, “I1”.

This error can be solved by mapping the input V and nodes onto different values for the standardized functions.