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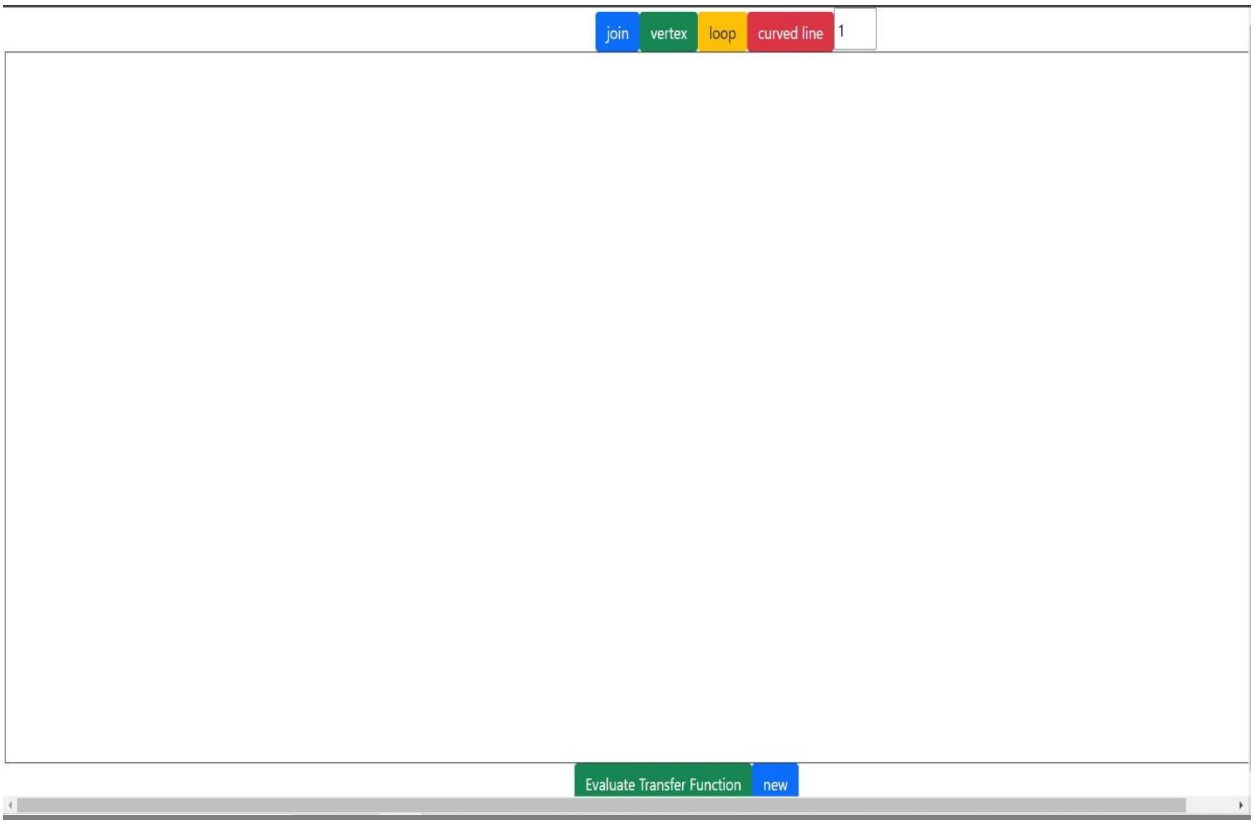
Project

Signal flow application



Problem statement

It's required to design a graphical interface program to draw a signal flow graph, solve that signal flow graph and get all the information from the graph (forward paths, loops, delta, and transfer function)

Program features:

1- the program is a web application, so it uses web graphical interface

2- Program can draw any number of nodes and prances

3- The program gets all the information from the graph (e.g., forward paths, loops, deltas and the overall transfer function)

Data structure:

Arrays,

Hash table,

Map,

Arraylist,

linkedList,

Linked hash mab,

All they are used to save the nodes and the gains to calculate the overall transfer function

Main modules:

a. **Front end:**

1- Line module: responsible for drawing a straight line

2- Loop module: responsible for drawing a self-loop

3- Curved line module: responsible for drawing a loop between 2 different nodes

4- The main module: which deal with the user and take the input form him to determine which operation to do

b. **Back end:**

ForwardPaths: get the forward paths in the graph

Graph: the main graph which do the operation over the graph

Isolated: to get the isolated loops in the graph

Loops: responsible for getting the loops from the graph

Solve: solve the graph after getting the loops and isolated

Algorithm used:

1- DFS: to go through the graph and check all the nodes in the shape

2- Elementary cycle: to go through the loops and get the information from it

Assumption:

1- User should choose type of the branch (straight line, loop, self loop)

2- Last node is the output node, so there is no output from the middle of the graph

3- There can't by any loop out of the output node in case the user want such case he should ad new node connected with the output node with gain = 1

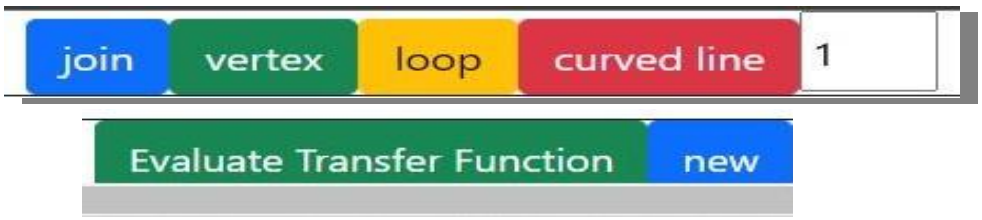
Simple user guide

a. To run the program for the first time:

1- user should add the modules to run the application (write "npm install -g node-modules" in the terminal of IDE)

2- user should write "ng serve --open" in the terminal of the IDE

b. to draw the signal flow graph:



1- to add new node press "vertex" button

2- to connect two nodes with straight line: click on the first node, then click on the second node then click "join" button

3- to draw a loop between two nodes: choose the first node, choose the second node then click "curved line" button

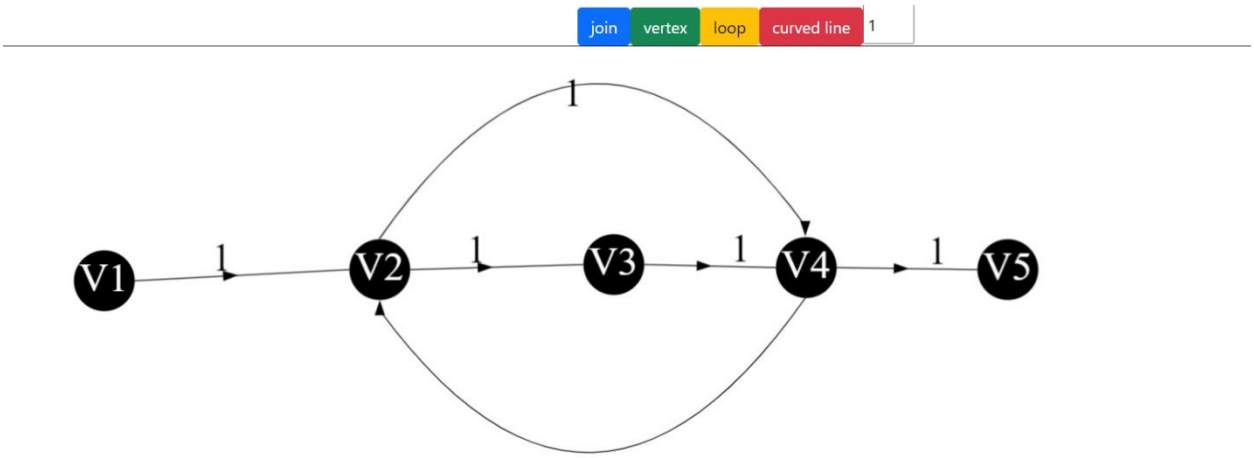
4- to draw a self loop on any loop: choose the node you want then click "loop" button

5- add the gain in the text box next to the buttons

6- at the end user should click evaluate transfer function to get the result and all info from the graph

7- in case any error appear in the shape user can choose new button to start new graph

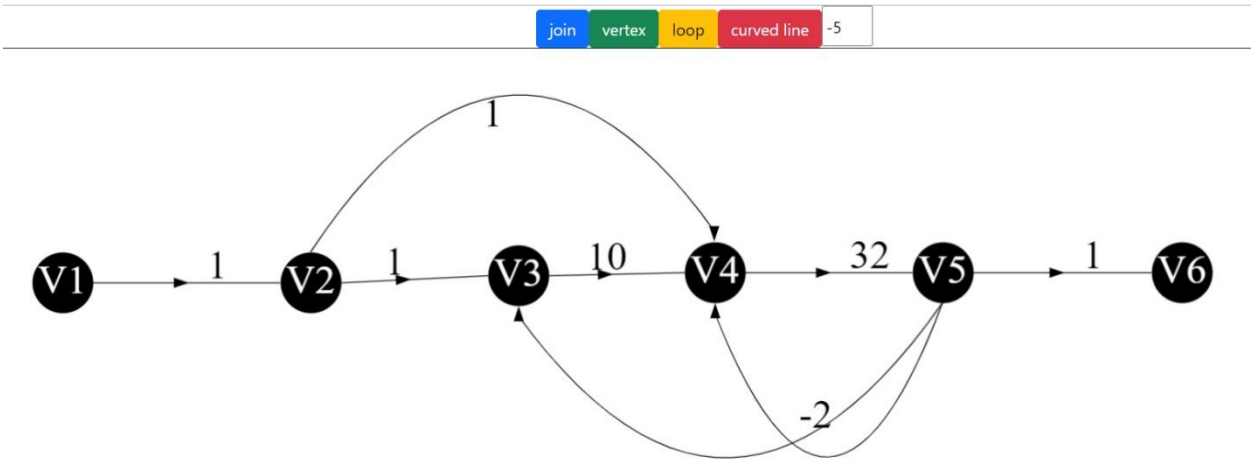
Sample runs:



Result : -2.0

1

Forward paths are : [1, 2, 3, 4, 5][1, 2, 4, 5]
Individual Loops paths are : [2, 3, 4, 2][2, 4, 2]
Delata 1 is : 1
Delata 2 is : 1

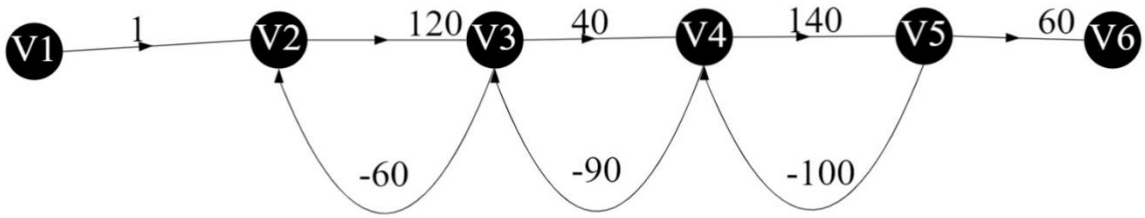


Result : 0.2114114114114114

-5

Forward paths are : [1, 2, 3, 4, 5, 6][1, 2, 4, 5, 6]
Individual Loops paths are : [3, 4, 5, 3][4, 5, 4]
Delata 1 is : 1
Delata 2 is : 1

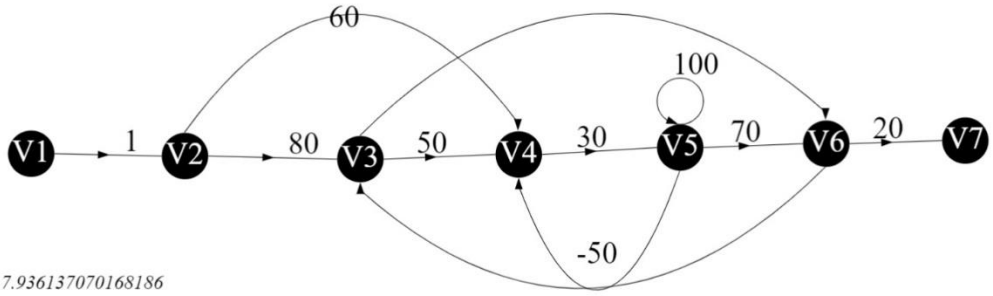
join vertex loop curved line -90



Result : 0.3999016075419777
Forward paths are : [1, 2, 3, 4, 5, 6]
Individual Loops paths are : [2, 3, 2][3, 4, 3][4, 5, 4]
02 Non-touching loops are : [2, 3, 2][4, 5, 4]
Delata 1 is : 1

join vertex loop curved line 100

50

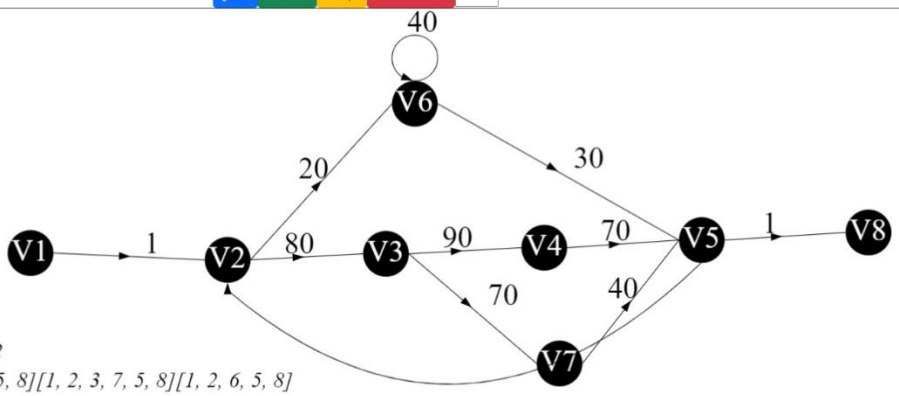


Result : 17.936137070168186
Forward paths are : [1, 2, 3, 4, 5, 6, 7][1, 2, 3, 6, 7][1, 2, 4, 5, 6, 7]
Individual Loops paths are : [3, 4, 5, 6, 3][3, 6, 3][4, 5, 4][5, 5]
Non-touching loops : [3, 6, 3][4, 5, 4]
Non-touching loops : [3, 6, 3][5, 5]
Delata 1 is : 1
Delata 2 is : 1401
Delata 3 is : 1

-90

Evaluate Transfer Function new

join vertex loop curved line -60



Result : 0.016666666285095732
Forward paths are : [1, 2, 3, 4, 5, 8][1, 2, 3, 7, 5, 8][1, 2, 6, 5, 8]
Individual Loops paths are : [2, 3, 4, 5, 2][2, 3, 7, 5, 2][2, 6, 5, 2][6, 6]
Non-touching loops : [2, 3, 4, 5, 2][6, 6]
Non-touching loops : [2, 3, 7, 5, 2][6, 6]
Delata 1 is : -39
Delata 2 is : -39
Delata 3 is : 1

-60

Evaluate Transfer Function new