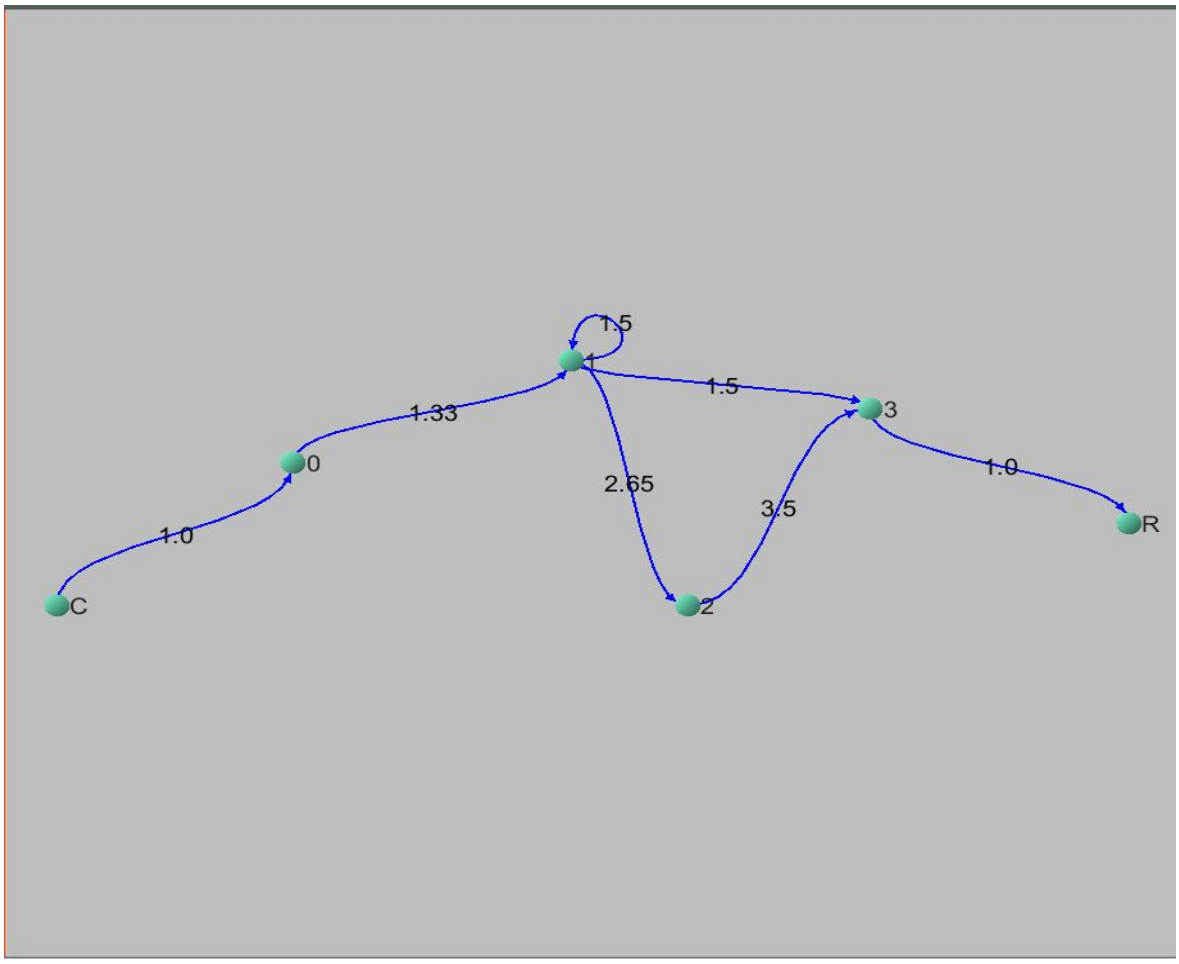
CS241

Signal Flow Grapher



Introduction

A **signal-flow graph** or **signal-flowgraph** (**SFG**), invented by Claude Shannon, but often called a **Mason graph** after Samuel Jefferson Mason who coined the term,is a specialized flow graph, a directed graph in which nodes represent system variables, and branches (edges, arcs, or arrows) represent functional connections between pairs of nodes. Thus, signal-flow graph theory builds on that of directed graphs (also called digraphs), which includes as well that of oriented graphs. This mathematical theory of digraphs exists, of course, quite apart from its applications.

SFG's are most commonly used to represent signal flow in a physical system and its controller(s), forming a cyber-physical system. Among their other uses are the representation of signal flow in various electronic networks and amplifiers, digital filters, state variable filters and some other types of analog filters. In nearly all literature, a signal-flow graph is associated with a set of linear equations.

Problem Statement :

Given: Signal flow graph representation of the system. Assume that total number of nodes and numeric branches gains are given.

Required:

1- Graphical interface.

2- Draw the signal flow graph showing nodes, branches, gains, ...

3- Listing all forward paths, individual loops, all combination of n non-touching loops.

4- The values of , 1 , ..., m where m is number of forward paths.

5- Overall system transfer function.

Main Modules :

1) Drawer which use graphic stream to draw on the gui .
2) Gui which is responsible for interacting with the user to use the program .
3) GraphData that builds graph and calculate the gain from node to other node .

Data Structures :

1) Hashset is used to get distinct nodes in a particular path .
2) Hashmap is used to encapsulate edges from a node to another node .
3) Regular dynamic arrays

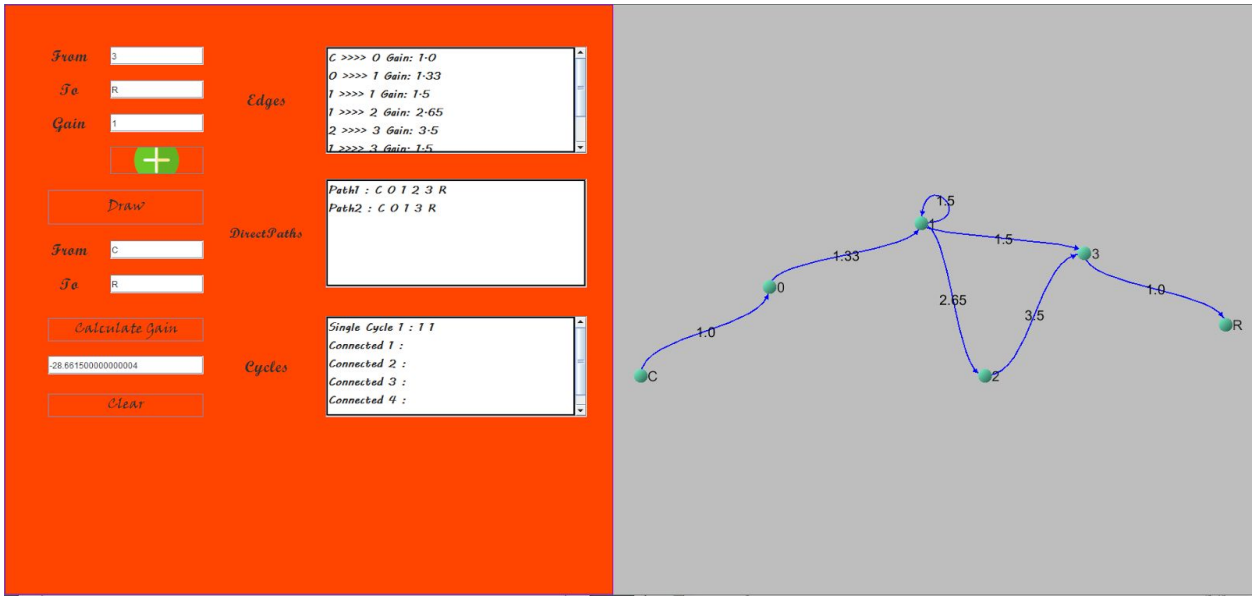
Main Features:

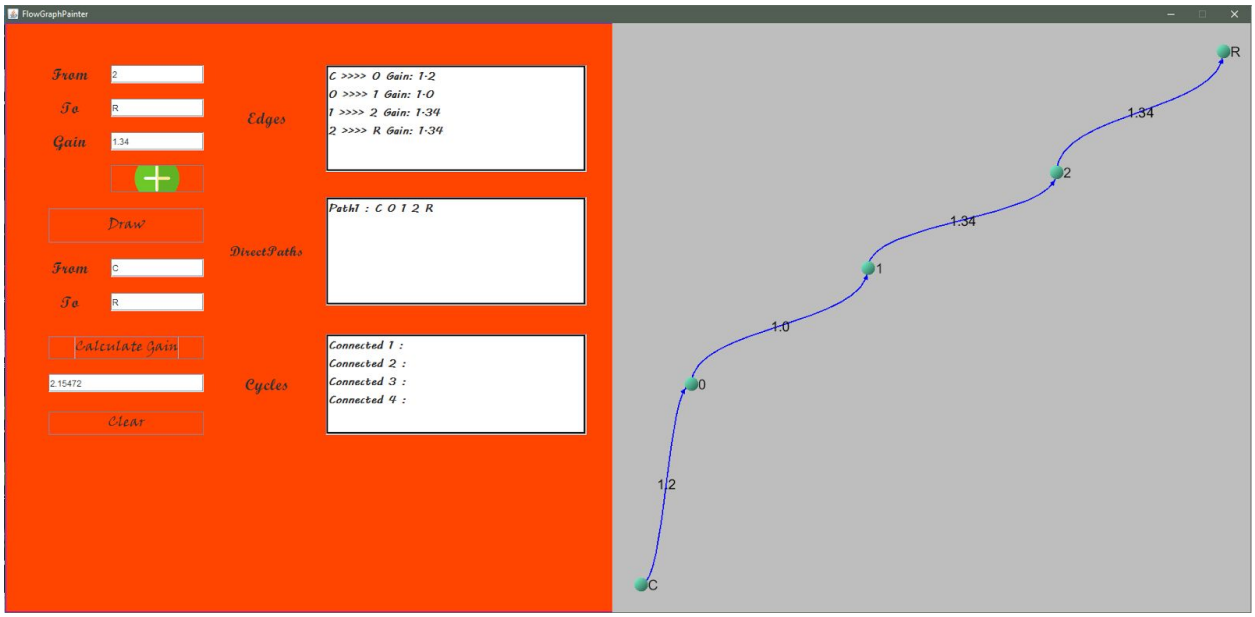
1) This app. Enables user to draw signal flow graph .
2) It enables user to calculate gain from a particular node to another node
3) It shows cycles , paths and merged cycles .

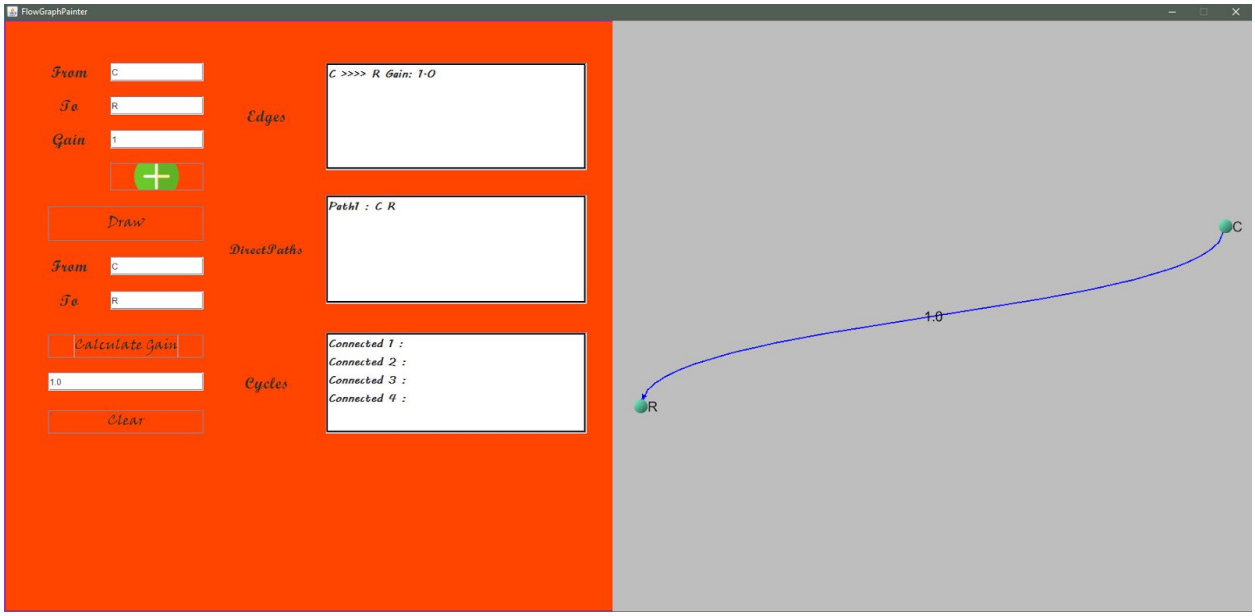
Algorithms Used :

1) Depth first search is used to get direct paths and cycles .

Sample Runs :




FlowGraphPainter
From
2
To
R
Gain
1.34
Draw
From
C
To
R
Calculate Gain
2.15472
Clear
Edges
C >>>> 0 Gain: 1.2
0 >>>> 1 Gain: 1.0
1 >>>> 2 Gain: 1.34
2 >>>> R Gain: 1.34
DirectPaths
Path1 : C 0 1 2 R
Cycles
Connected 1 :
Connected 2 :
Connected 3 :
Connected 4 :
R
1.34
2
1.34
1
1.0
0
1.2
C


FlowGraphPainter
From
C
To
R
Gain
1
Draw
From
C
To
R
Calculate Gain
1.0
Clear
Edges
C >>>> R Gain: 1.0
DirectPaths
Path1 : C R
Cycles
Connected 1 :
Connected 2 :
Connected 3 :
Connected 4 :
C
1.0
R

User Guide :

How can user draw the graph :

1) Enters symbol of the node in field from and symbol for the node that the edges is going to in the to field .
2) Enter value for the gain between the two nodes
3) Keep entering edges like that then click draw and the graph will appears for the user .

How can the user calculate :

1) Enters symbol that he will calculate the gain from in from field under draw button then the destination .
2) Click calculate gain and gain and all information about the paths appears for user .