Circuit Simulation Project

https://esim.fossee.in/circuit-simulation-project

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Project Guide : Dr. Maheswari. R

Title of Project :

Design of 4 to 2 Priority encoder using subcircuit builder in eSIM

Theory/Description:

Ordinary binary encoders generate wrong output when more than one input line is active high (1). There is also an ambiguity when the ordinary encoder produces zeros in all the output lines, since it could be the code corresponding to the inputs when the least significant input is one or when all the inputs are equal to zero.

A priority encoder can help in solving these problems. When more than one input line is active high at the same time , the priority encoder prioritizes every input level and allocates a priority level to each input.

Therefore, this is an encoder with a priority function. The input line with the highest priority becomes the output of this encoder and all the other input lines are ignored.

These priority encoders are used in many digital applications, especially when we have to select one particular input with the highest priority. For example, when multiple devices are trying to transmit data to a computer system, this encoder allows the device with the highest priority to access the computer among all other devices which have lower priority.

A 4 to 2 priority encoder has 4 inputs : Y3, Y2, Y1 & Y0 and 2 outputs : A1 & A0. Y3 is considered to have the highest priority whereas Y0 has the lowest priority. Therefore, even if more than one input line is active high, the output produces a binary code corresponding to the input that has the highest priority.

In order to resolve the ambiguity when all the output lines are zeroes, we consider one more output, V in order to know whether the code available at outputs is valid or not.

- The output produced is considered a valid one if atleast one of the input lines is '1'. If it is valid, V will be equal to '1'.

- The output produced is considered as an invalid output if all the input lines are zeroes. Invalid outputs produce V equal to '0'.

The **Truth table** of 4 to 2 priority encoder is shown below :

Y3	Y2	Y1	Y0	A1	A0	V
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	x	0	1	1
0	1	x	x	1	0	1
1	x	x	x	1	1	1

Circuit Diagrams:

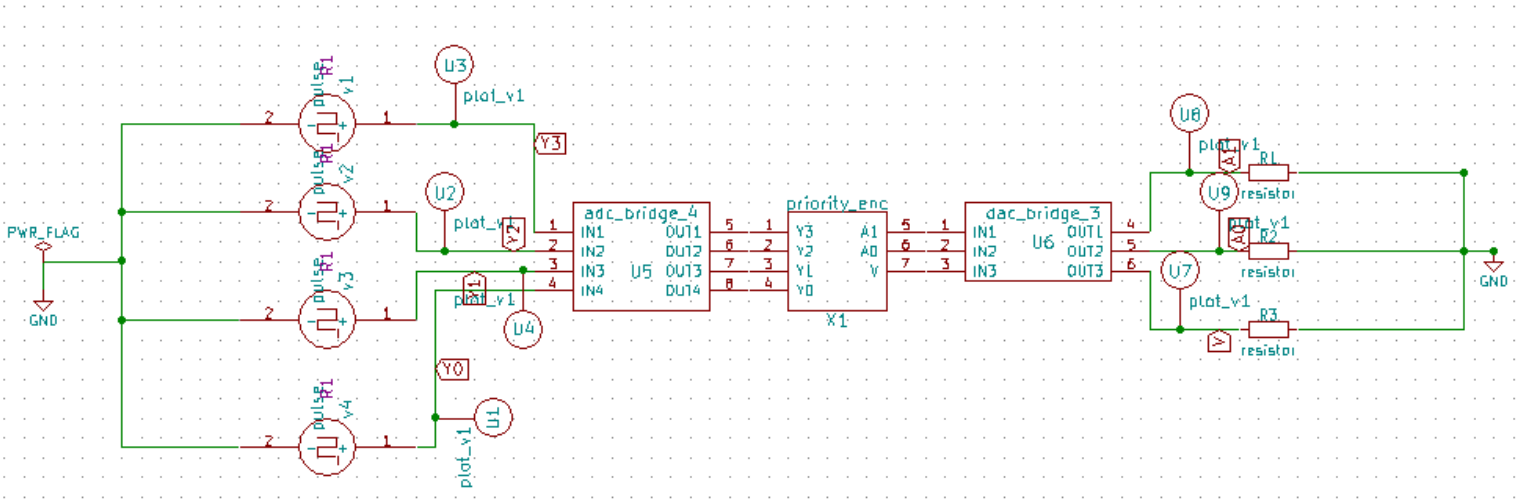


Figure 1: Main Circuit Schematic

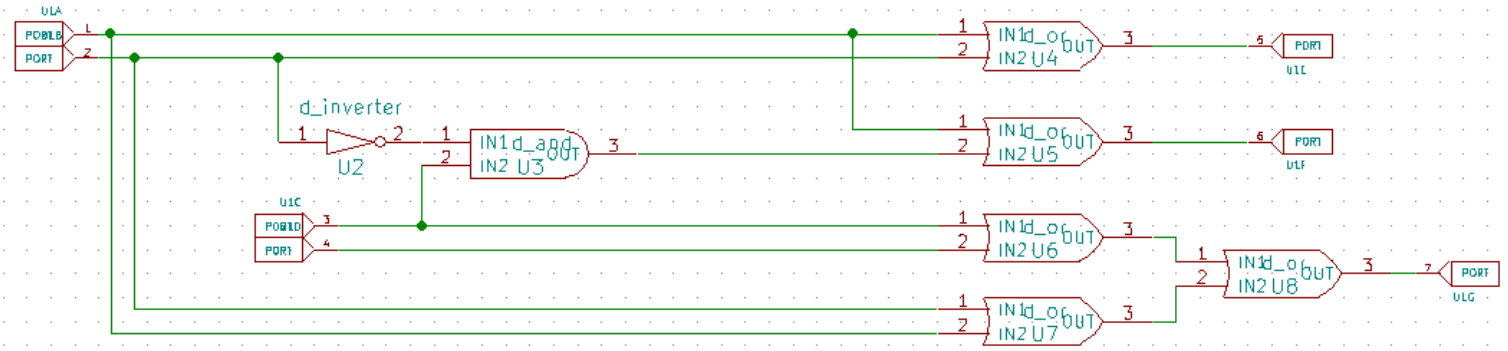


Figure 2: Sub-Circuit Schematic of 4 to 2 priority encoder

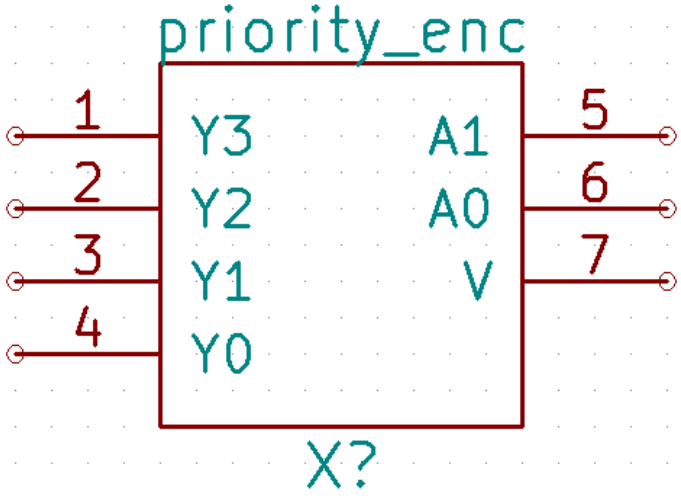
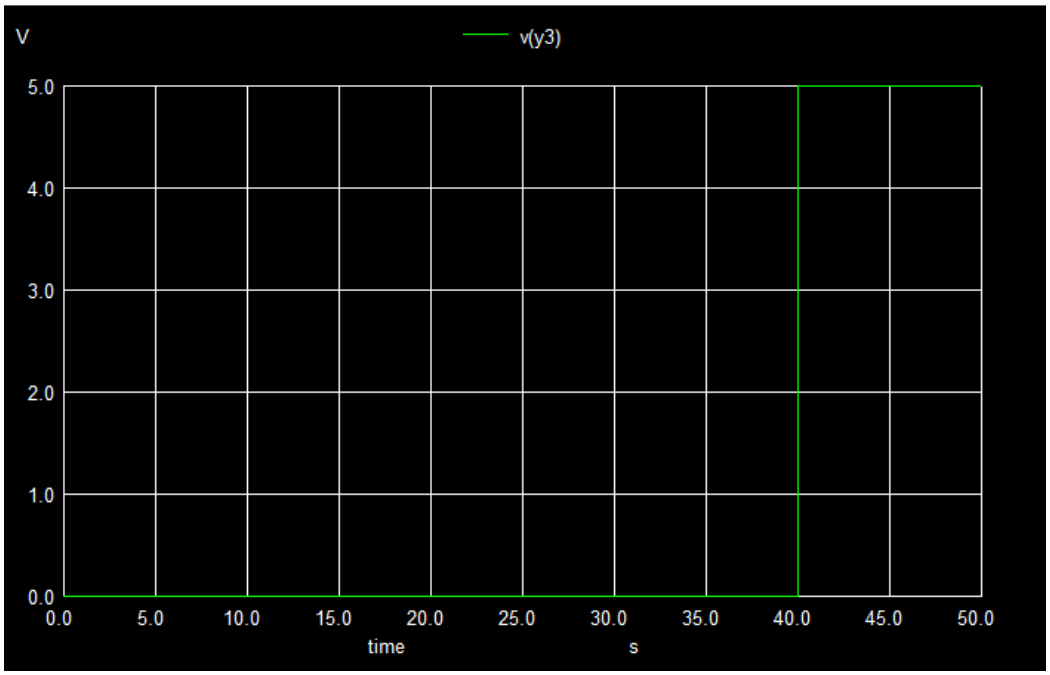


Figure 3: Symbol for 4 to 2 priority encoder

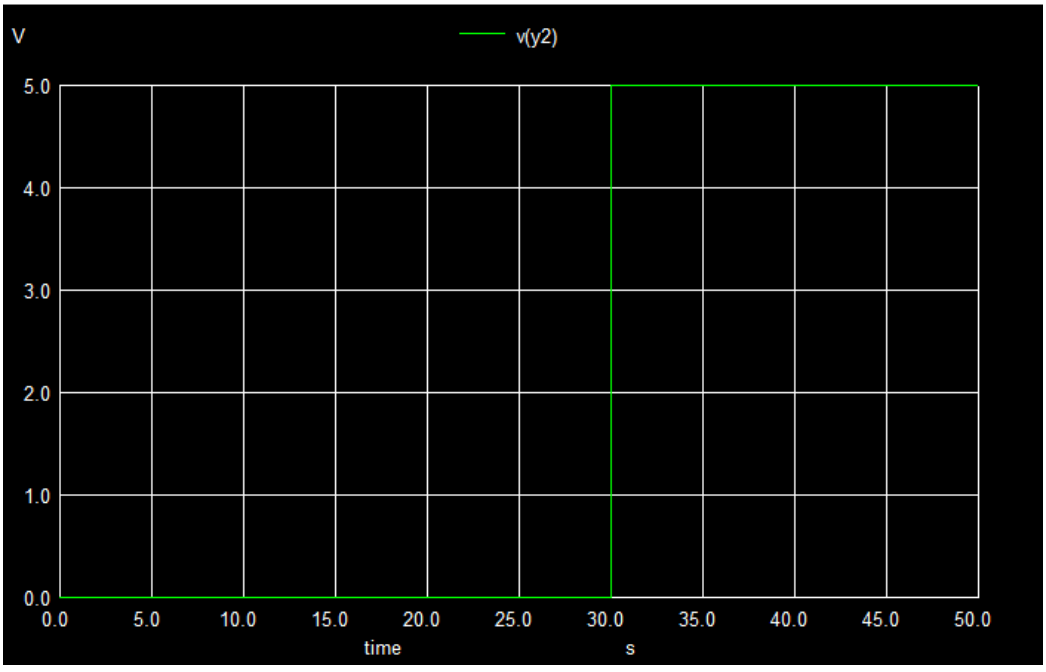
Result/Output:

- **Ngspice Plots :**

  Inputs :

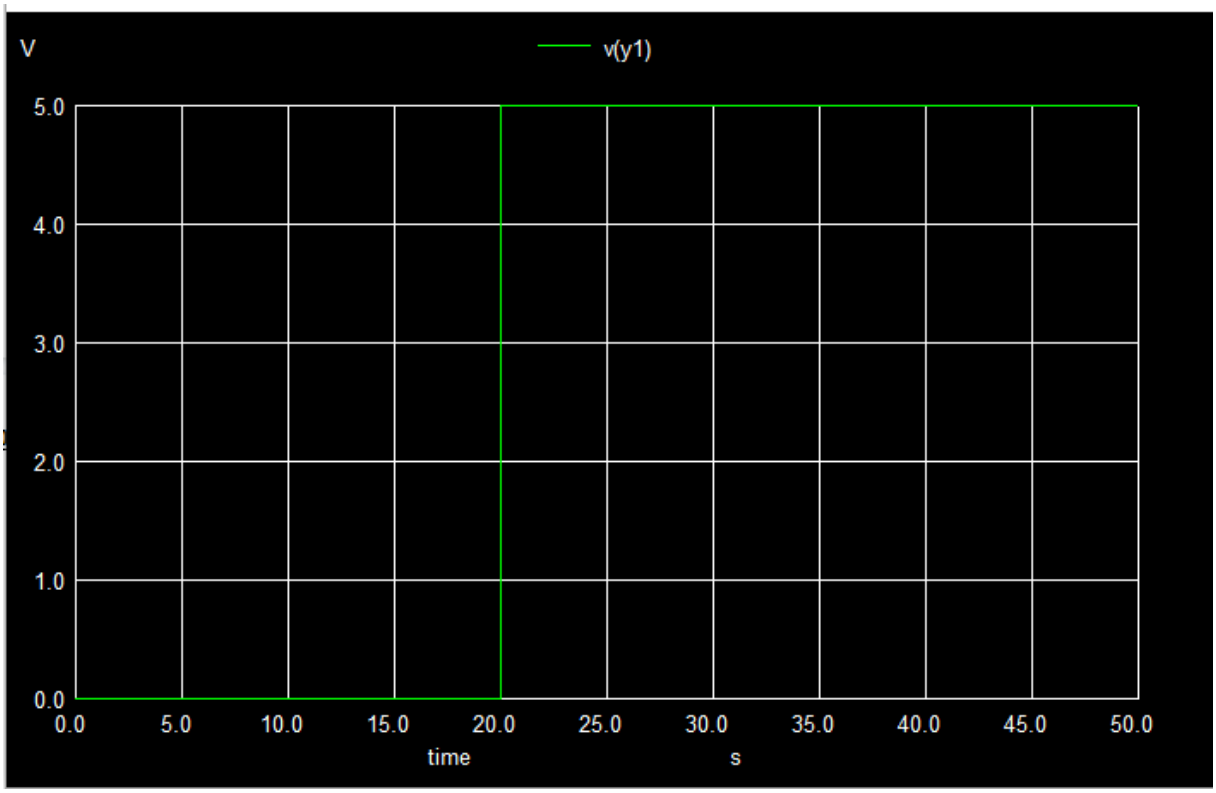


Y3

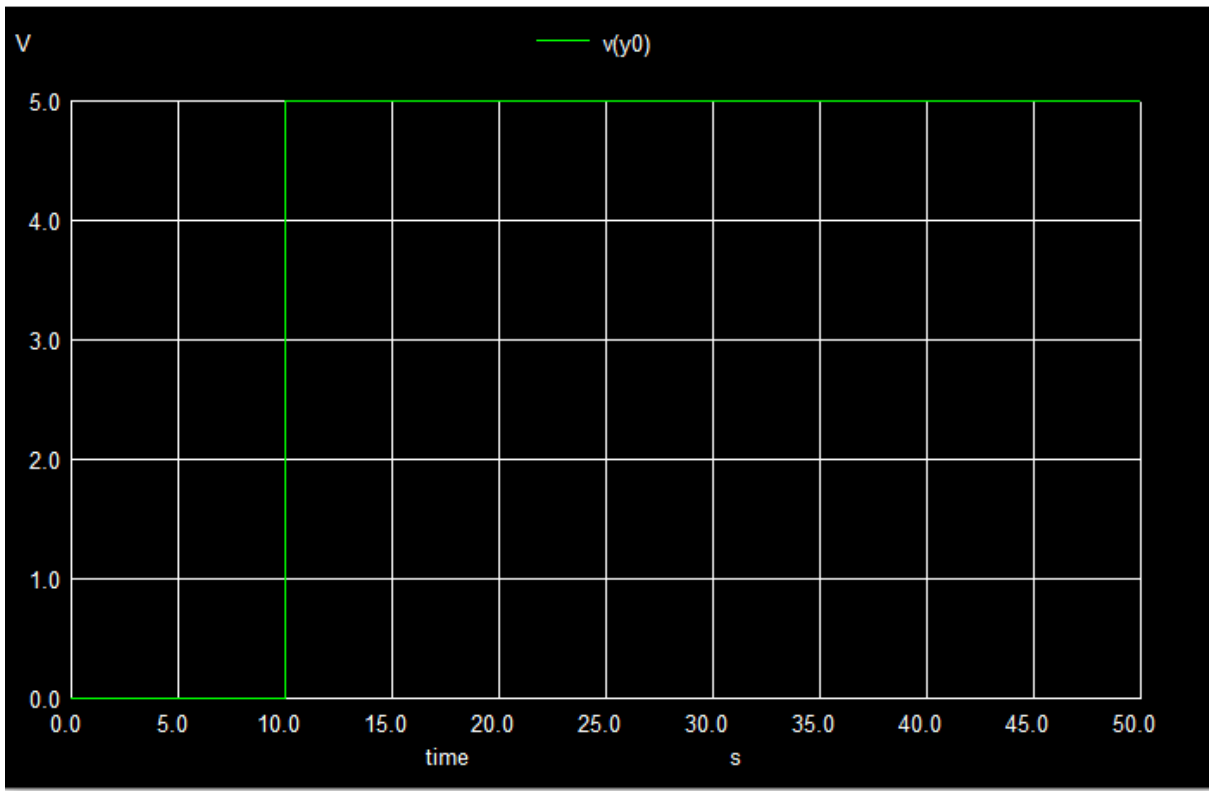


Y2

Inputs :

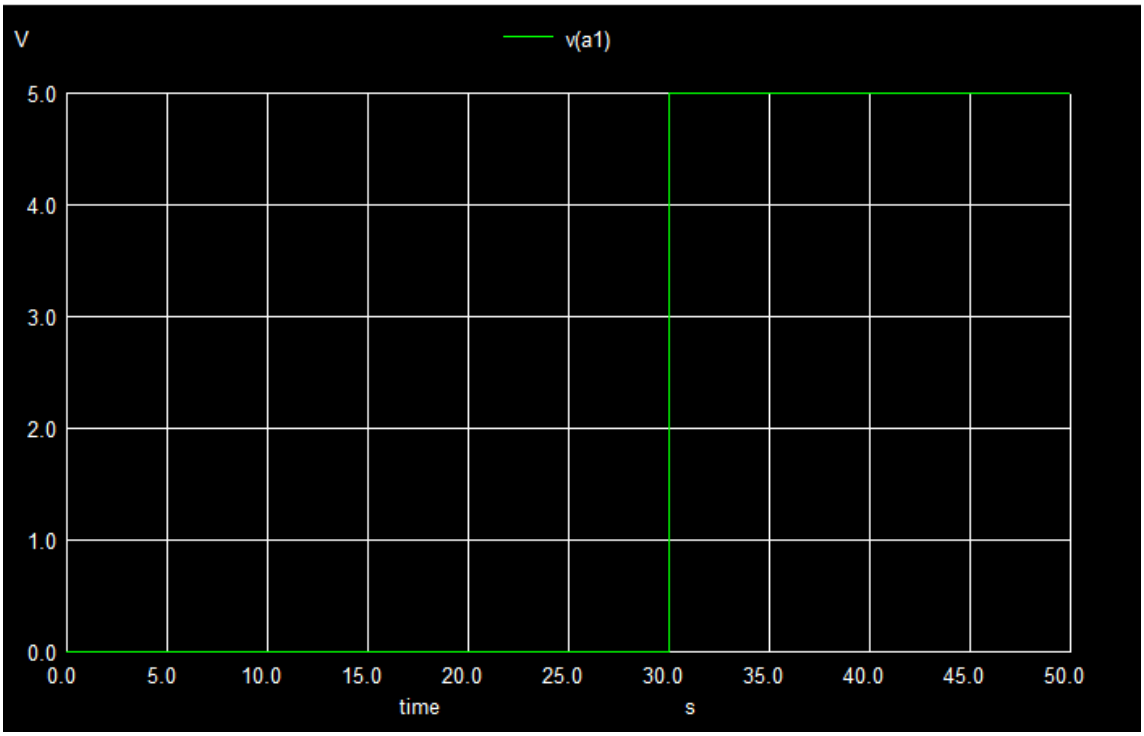

V
v(y1)
5.0
4.0
3.0
2.0
1.0
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
time
s

Y1

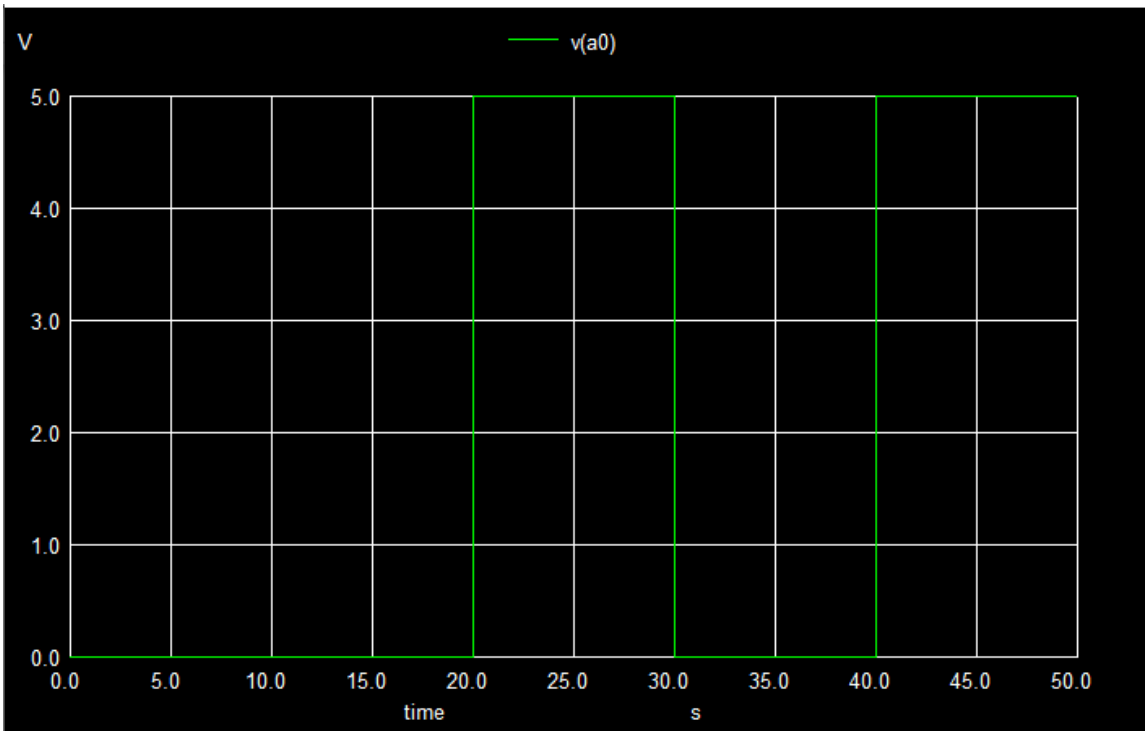

V
v(y0)
5.0
4.0
3.0
2.0
1.0
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
time
s

Y0

Outputs :

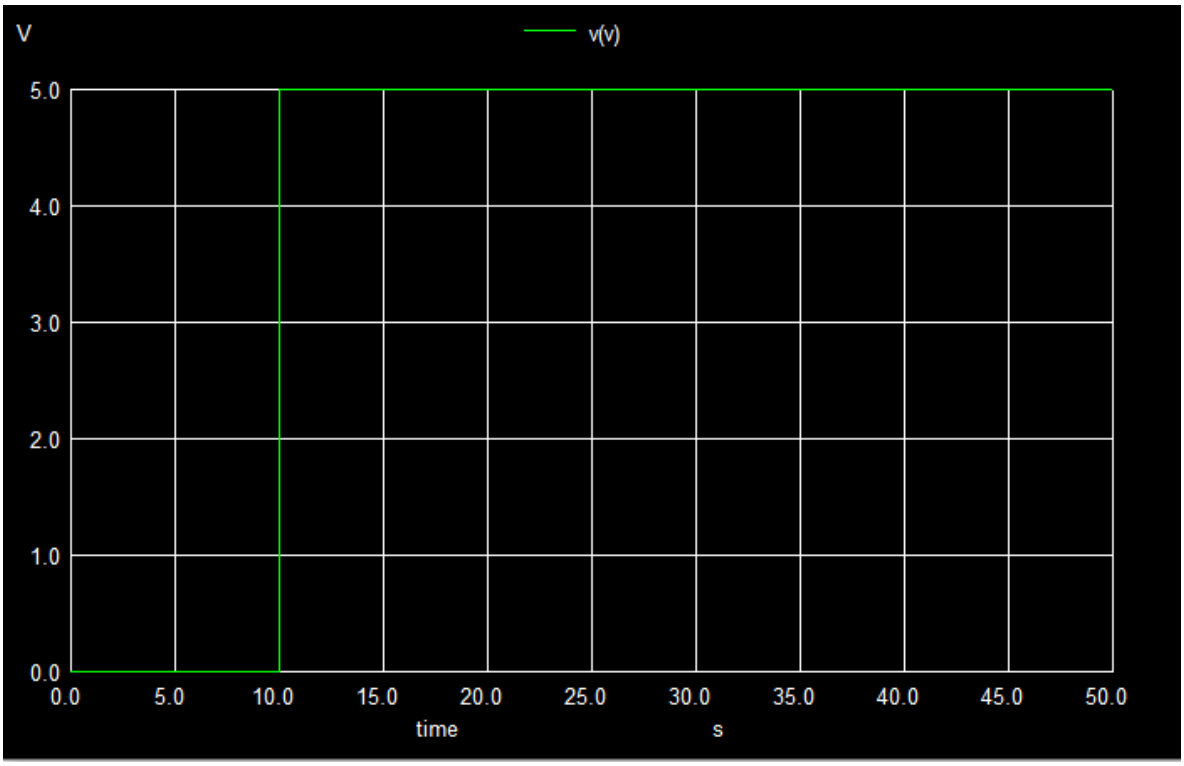


A1



A0

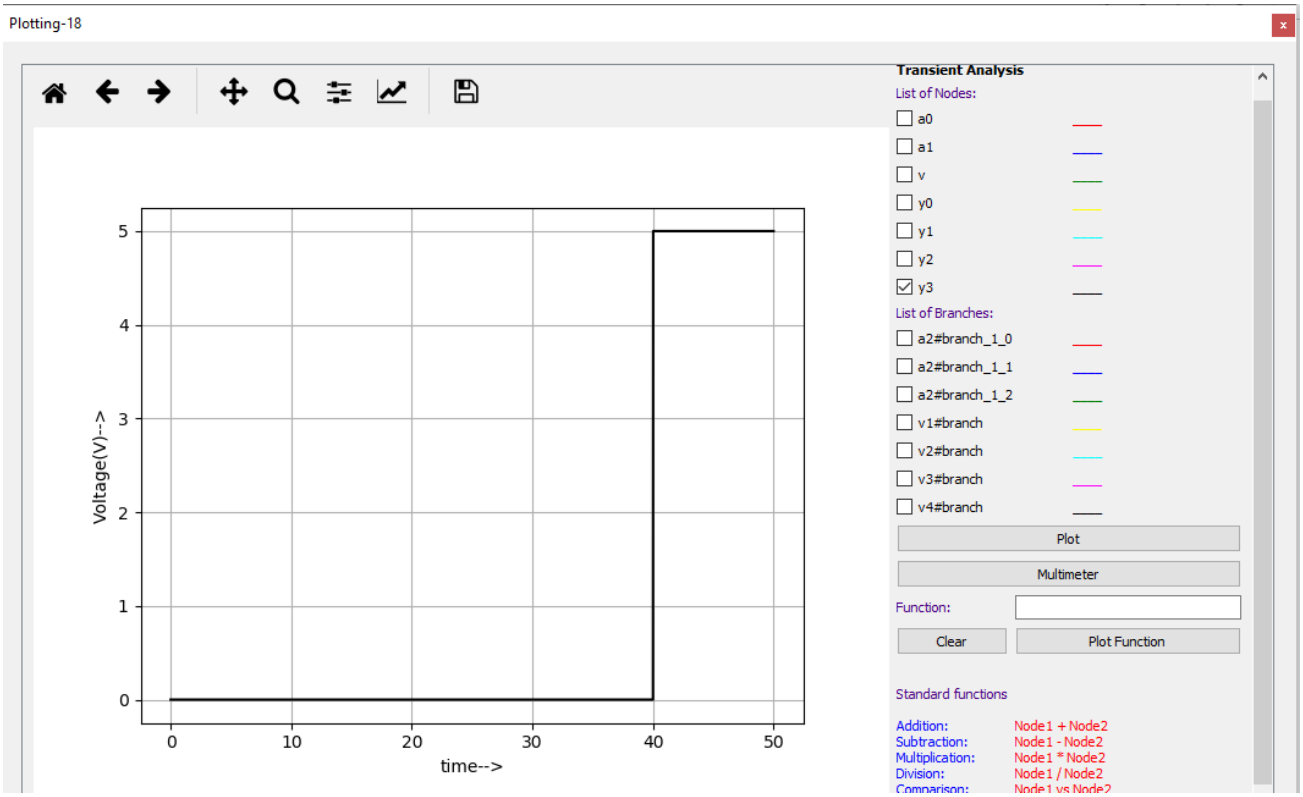
Outputs :


V
v(v)
5.0
4.0
3.0
2.0
1.0
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
time
s

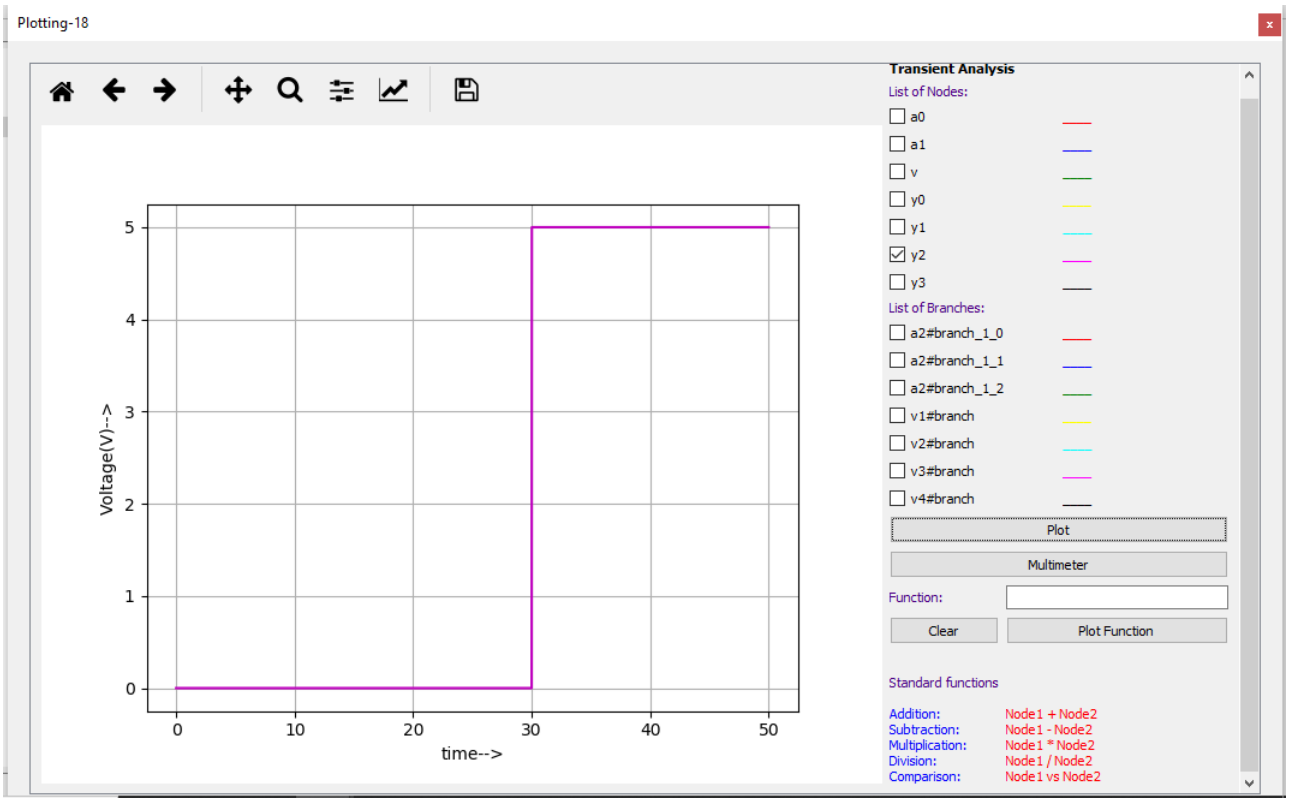
V

- **Python Plots :**

Inputs :

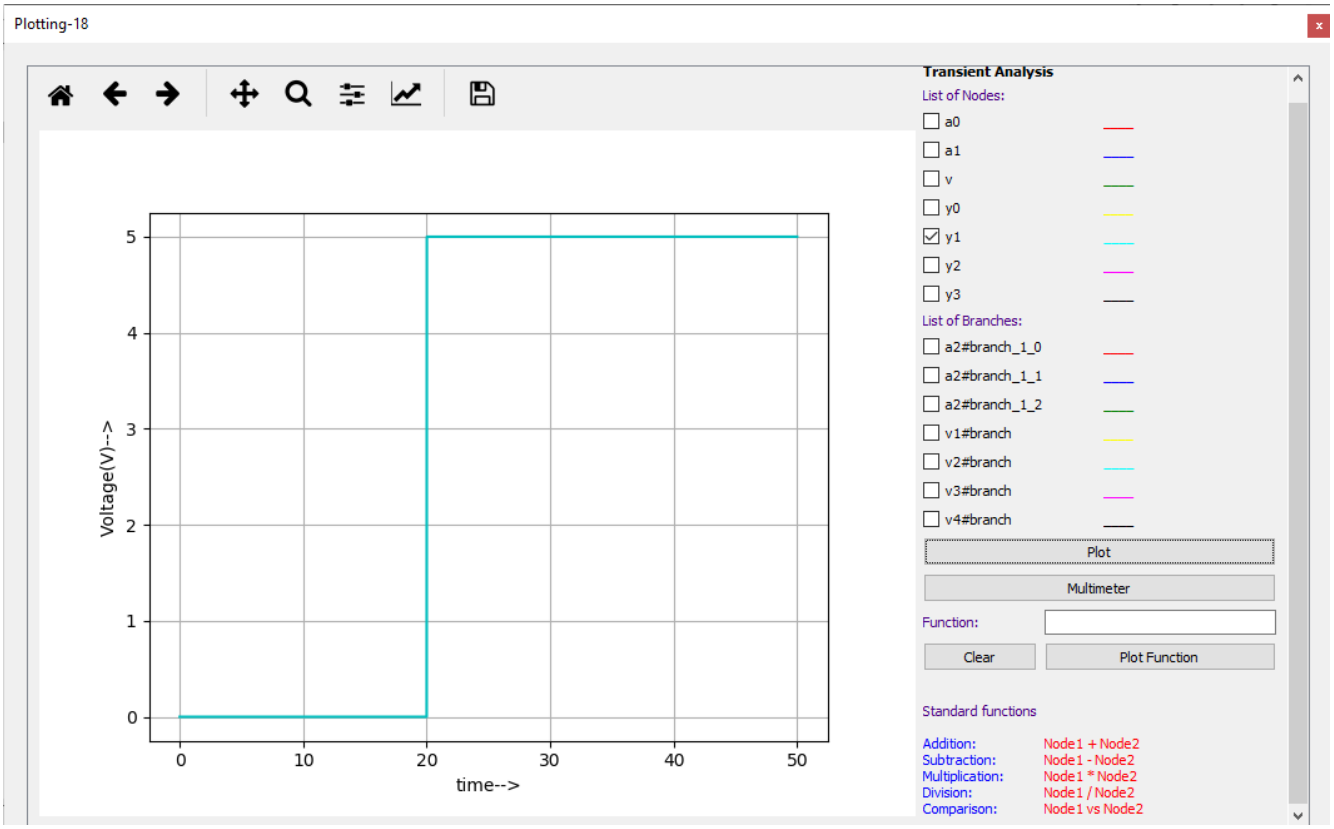


Y3

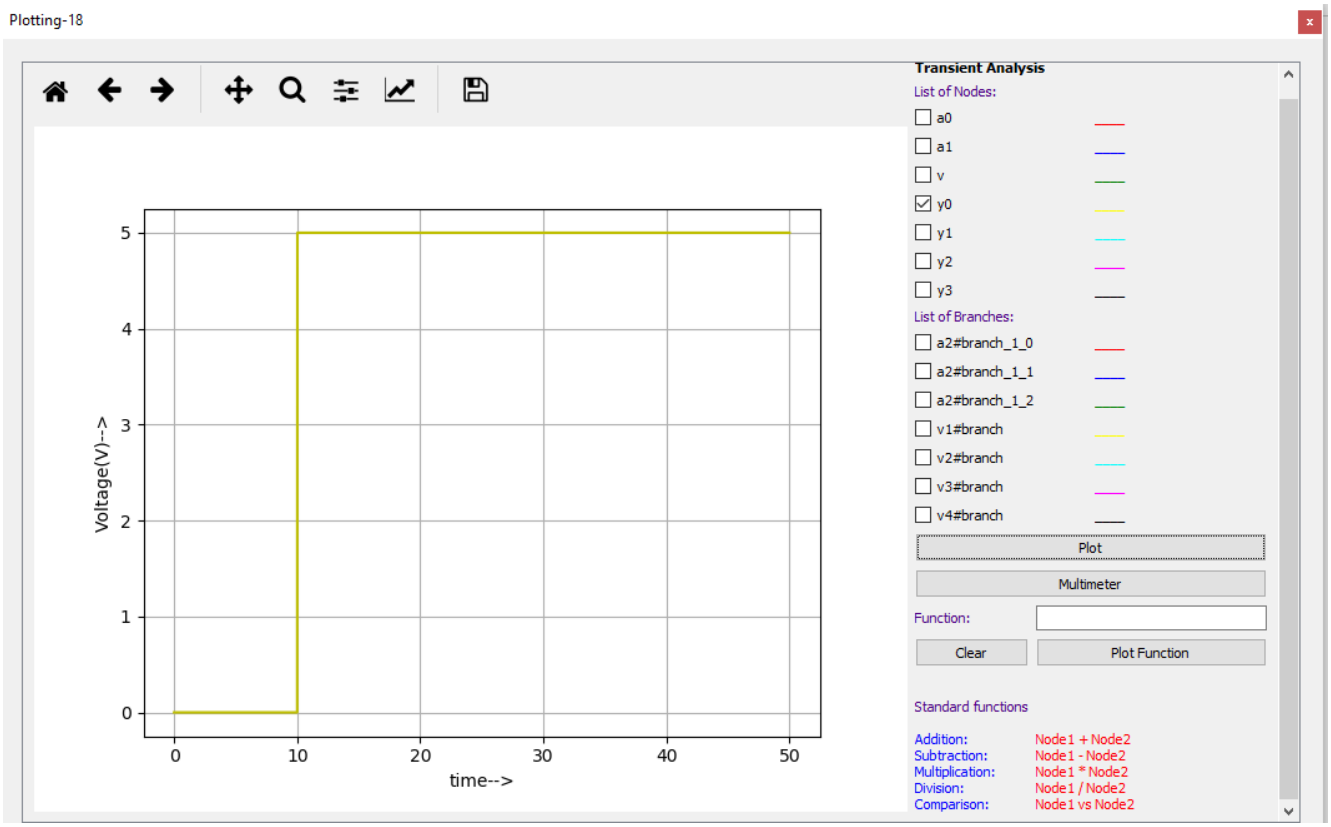


Y2

Inputs :

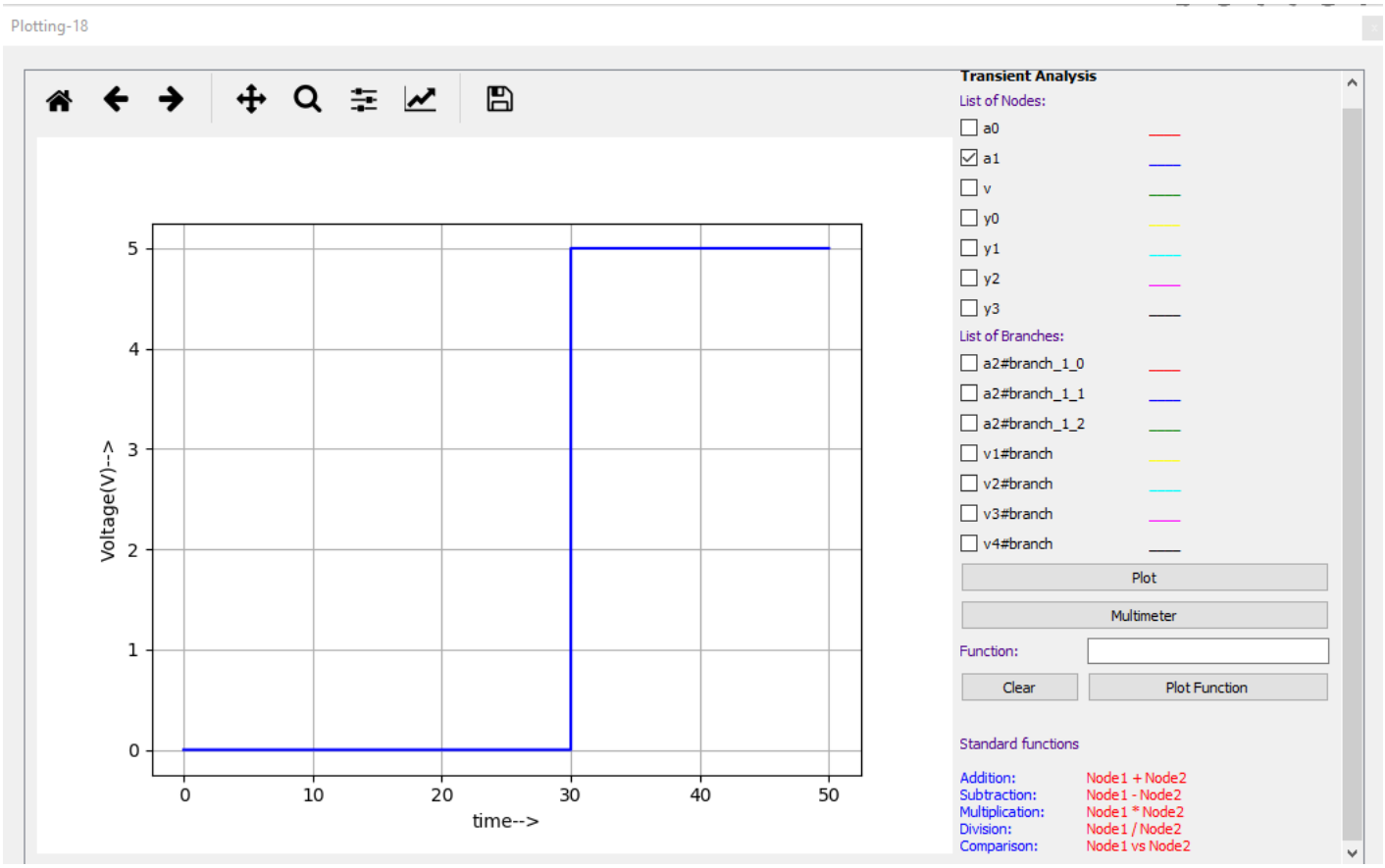

Plotting-18
Transient Analysis
List of Nodes:
a0
a1
v
y0
y1
y2
y3
List of Branches:
a2#branch_1_0
a2#branch_1_1
a2#branch_1_2
v1#branch
v2#branch
v3#branch
v4#branch
Plot
Multimeter
Function:
Clear
Plot Function
Standard functions
Addition: Node1 + Node2
Subtraction: Node1 - Node2
Multiplication: Node1 * Node2
Division: Node1 / Node2
Comparison: Node1 vs Node2
Voltage(V)-->
time-->

Y1

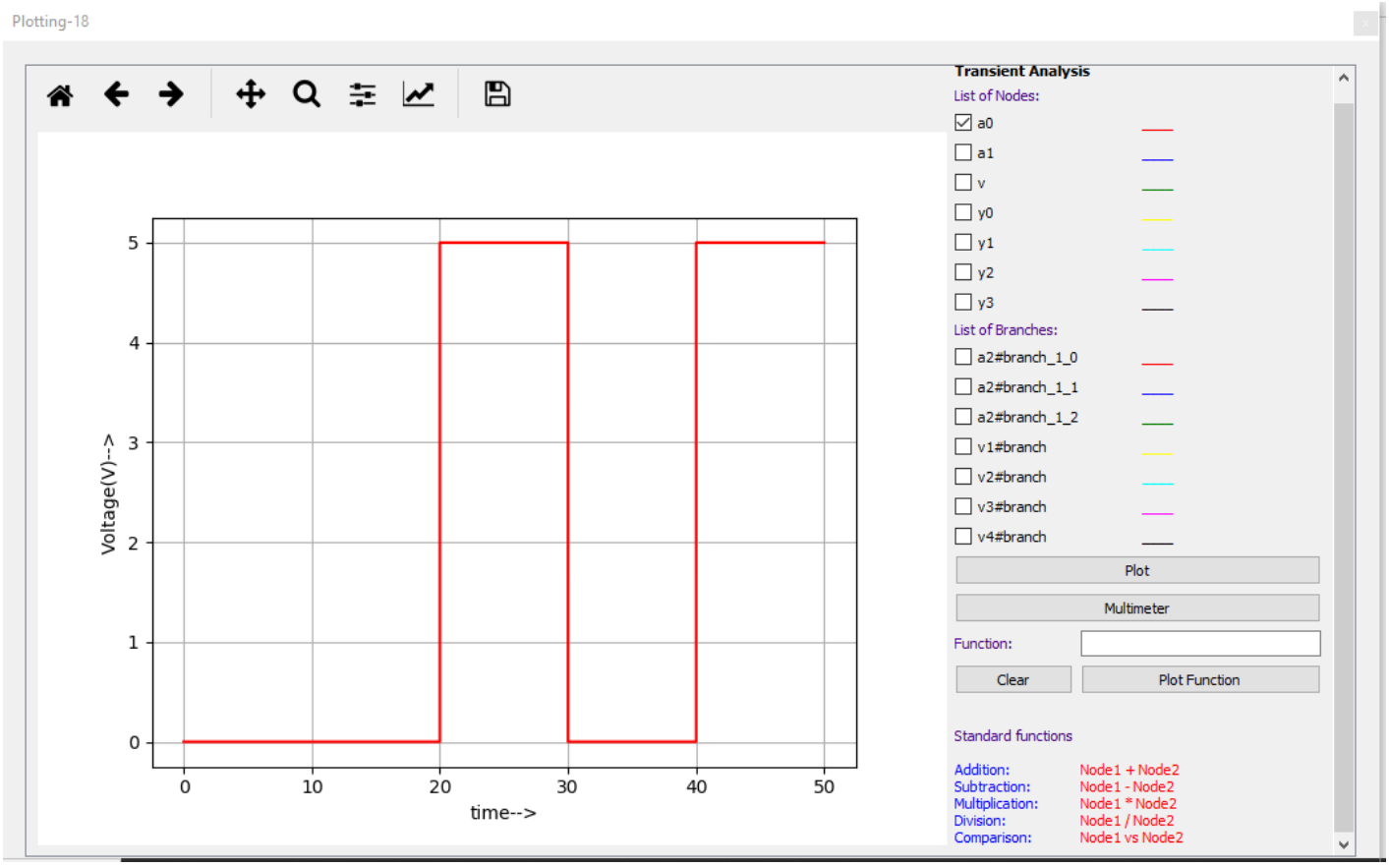

Plotting-18
Transient Analysis
List of Nodes:
a0
a1
v
y0
y1
y2
y3
List of Branches:
a2#branch_1_0
a2#branch_1_1
a2#branch_1_2
v1#branch
v2#branch
v3#branch
v4#branch
Plot
Multimeter
Function:
Clear
Plot Function
Standard functions
Addition: Node1 + Node2
Subtraction: Node1 - Node2
Multiplication: Node1 * Node2
Division: Node1 / Node2
Comparison: Node1 vs Node2
Voltage(V)-->
time-->

Y0

Outputs :

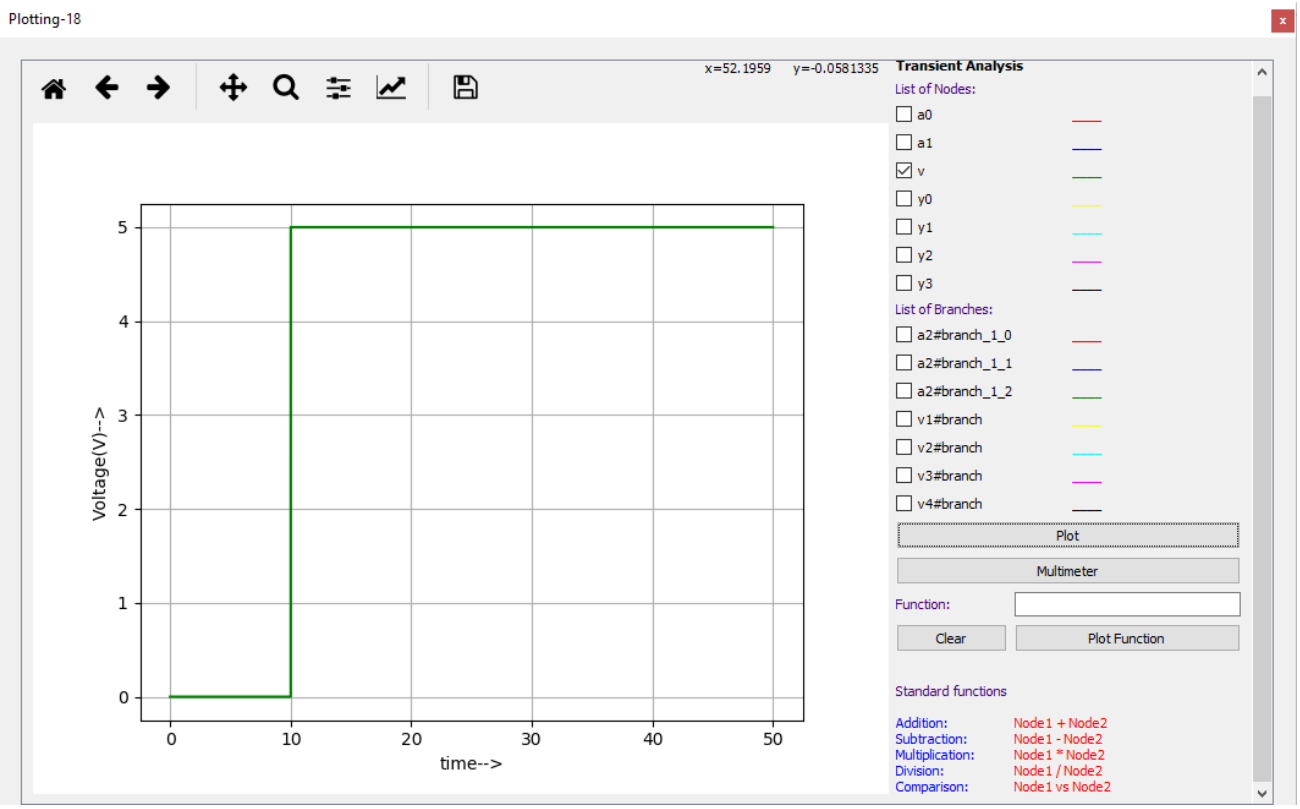


A1



A0

Outputs :



V

References :

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