Circuit Simulation Project

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

Name of Participant: S Gopi

Project Guide: Dr. Maheswari. R

Title of the Project: -

Design of Half Adder Circuit using Subcircuit Builder in eSIM

Theory/Description: -

Adders form a core component of the Arithmetic Logic Unit (ALU) and play a major role in calculating memory addresses, table indices, etc.

A half adder is the simplest digital adder. It is a combinational circuit that performs the addition of two input binary digits and produces two binary digits, namely, the sum bit and the carry bit as output. The 'augend' and 'addend' bits are two input states, and 'sum' and 'carry' are two output states of the half adder. If A and B are the input bits, then sum bit (S) is the X-OR of A and B and the carry bit (C) will be the AND of A and B. The adder works by combining the operations of basic logic gates, with the simplest form using only a XOR and an AND gate. However, this can also be converted into a circuit that only has AND, OR and NOT gates.

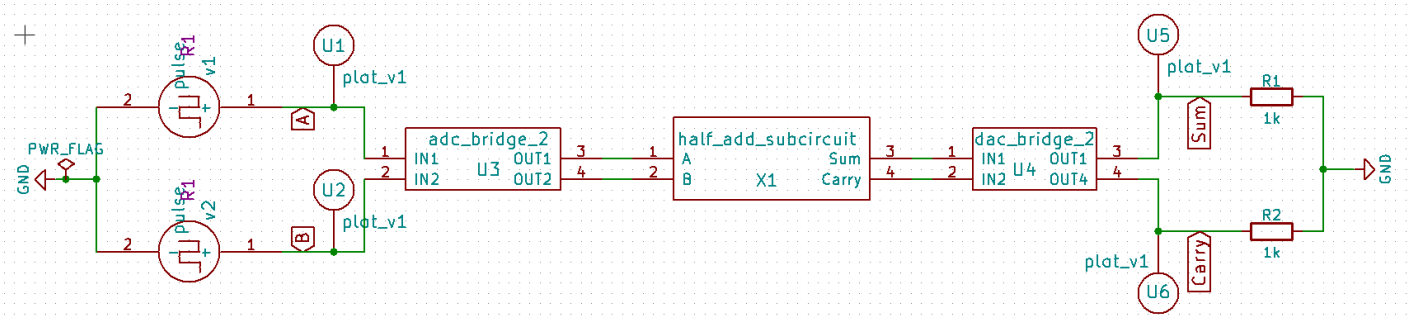
Basically, 2 Half Adder circuits can be merged together to form a single Full Adder circuit, in other words, a single Half Adder does half the work of a Full Adder.

The truth table for adding two binary digits A and B is shown below:

A	B	SUM	CARRY
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

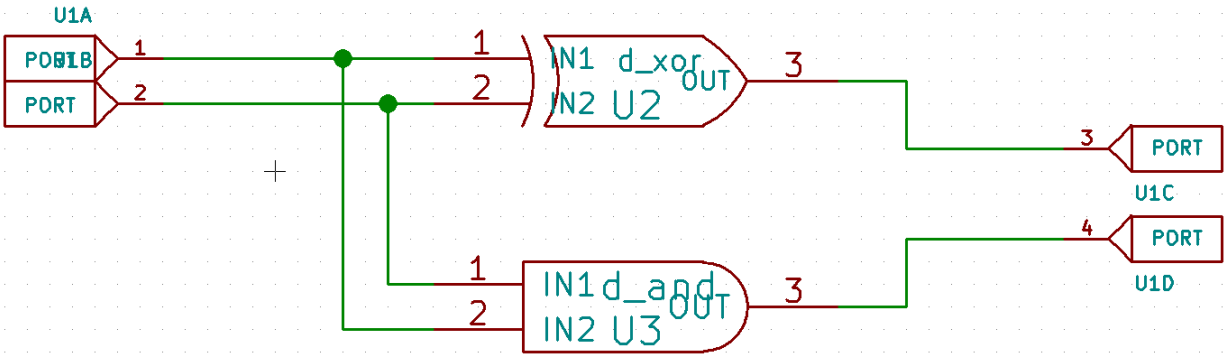
Circuit Diagrams: -

- This is the main functional circuit schematic for Half Adder which uses a subcircuit:



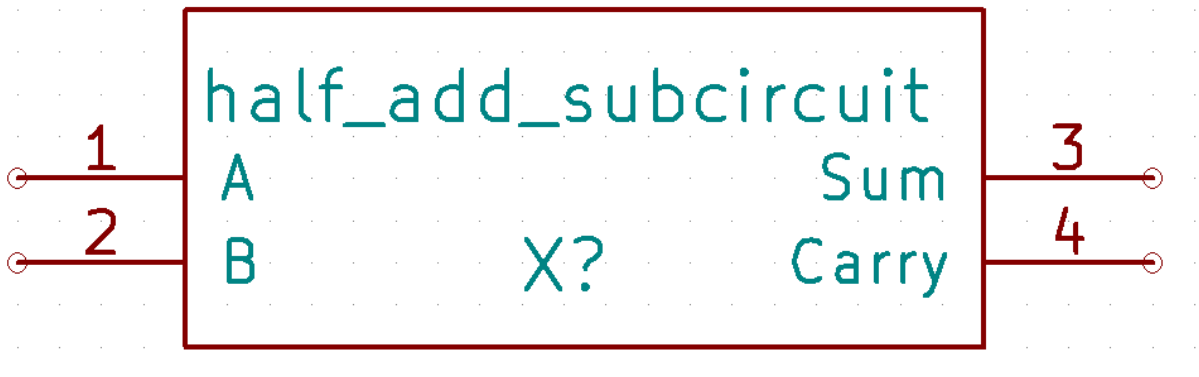
Main Circuit Schematic – Half Adder using Subcircuit

- A subcircuit is used for half addition. The internal structure of the Half Adder is shown below:



Subcircuit Schematic for Half Adder

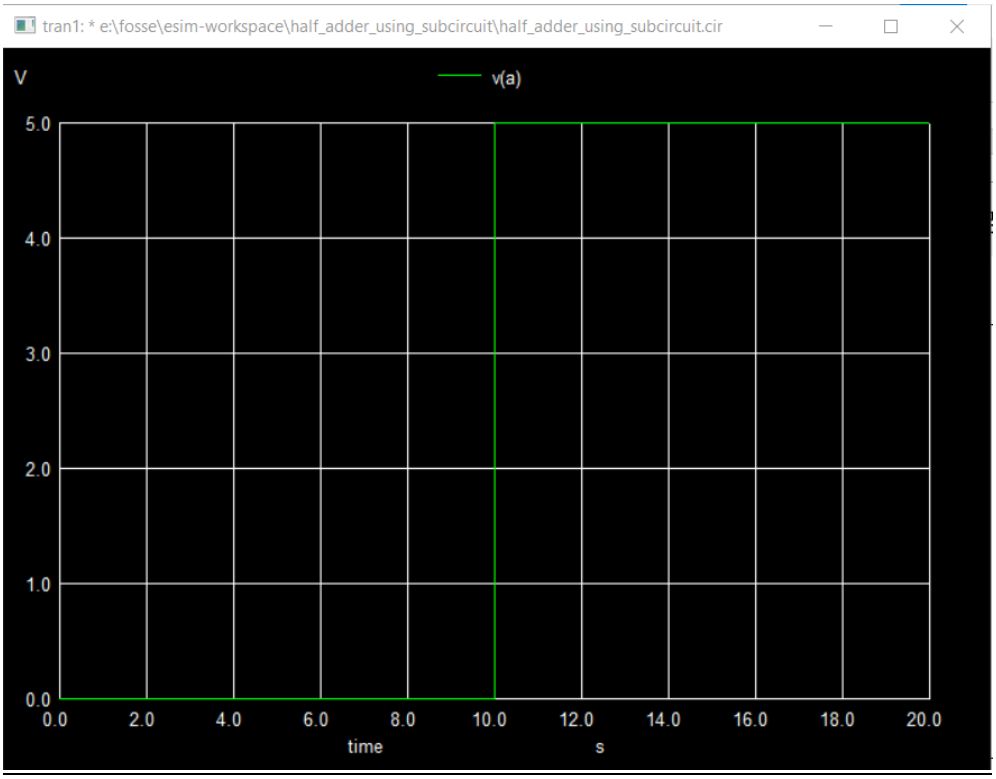
- The symbol defined/designed to represent the subcircuit is shown below:



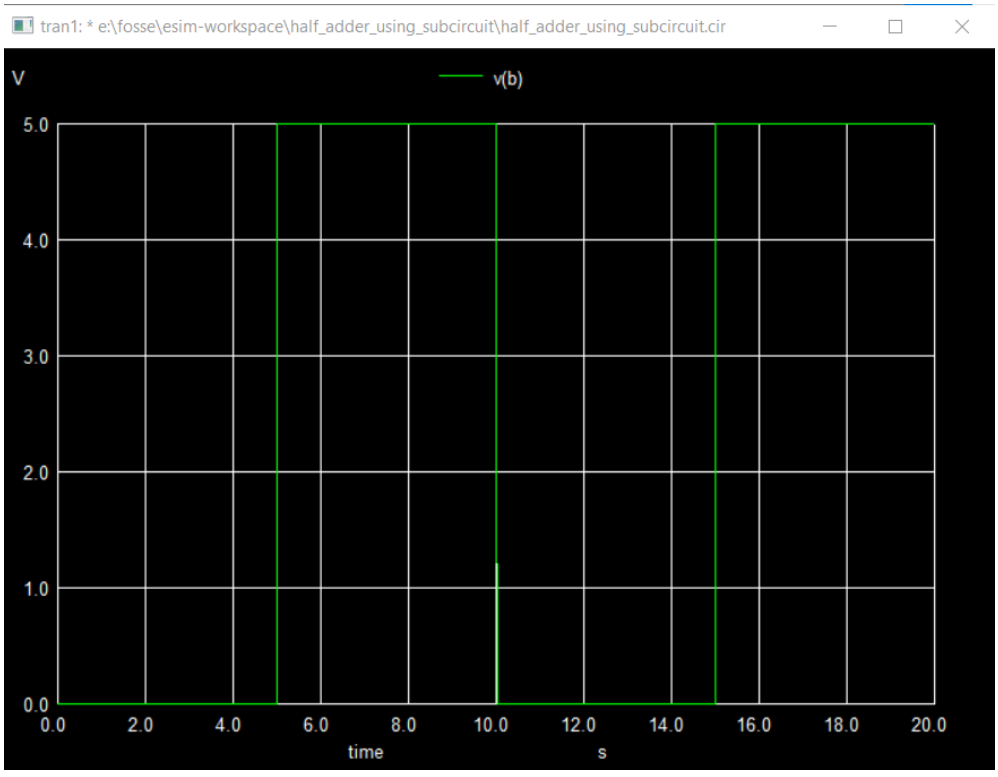
Subcircuit Symbol for Half Adder

Result/Output: -

- **Ngspice Plots: -**
  - Inputs: -

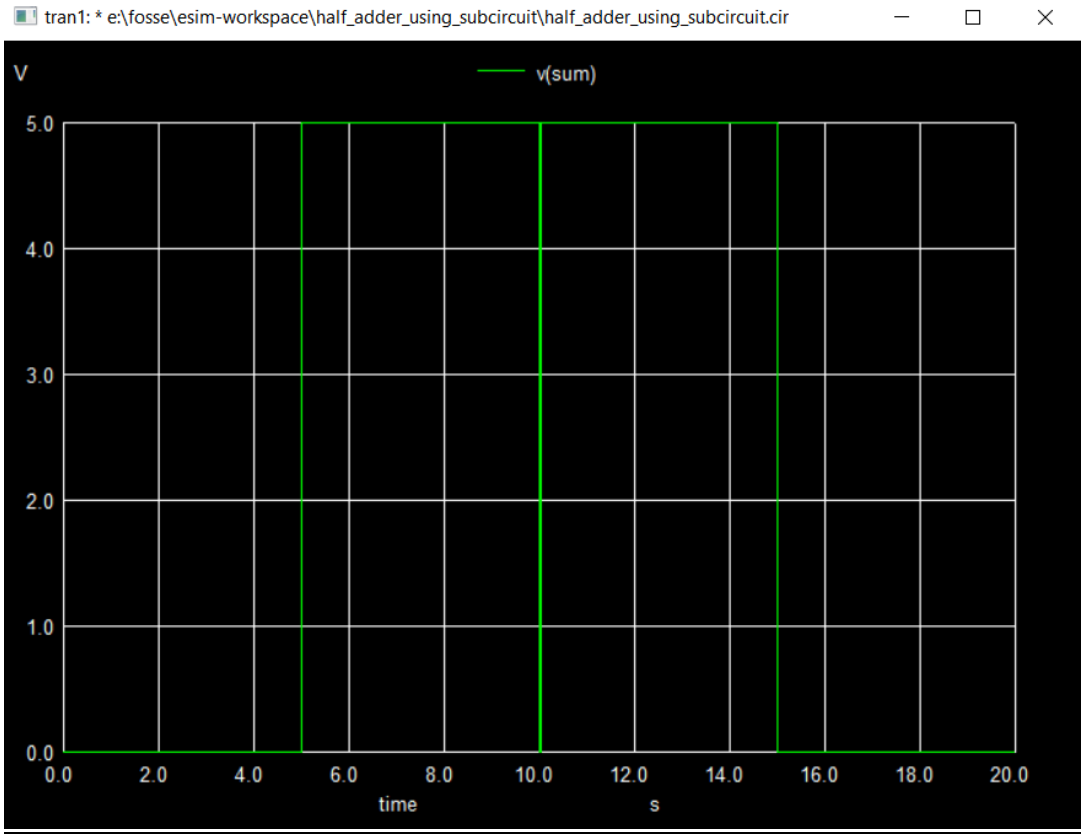


A

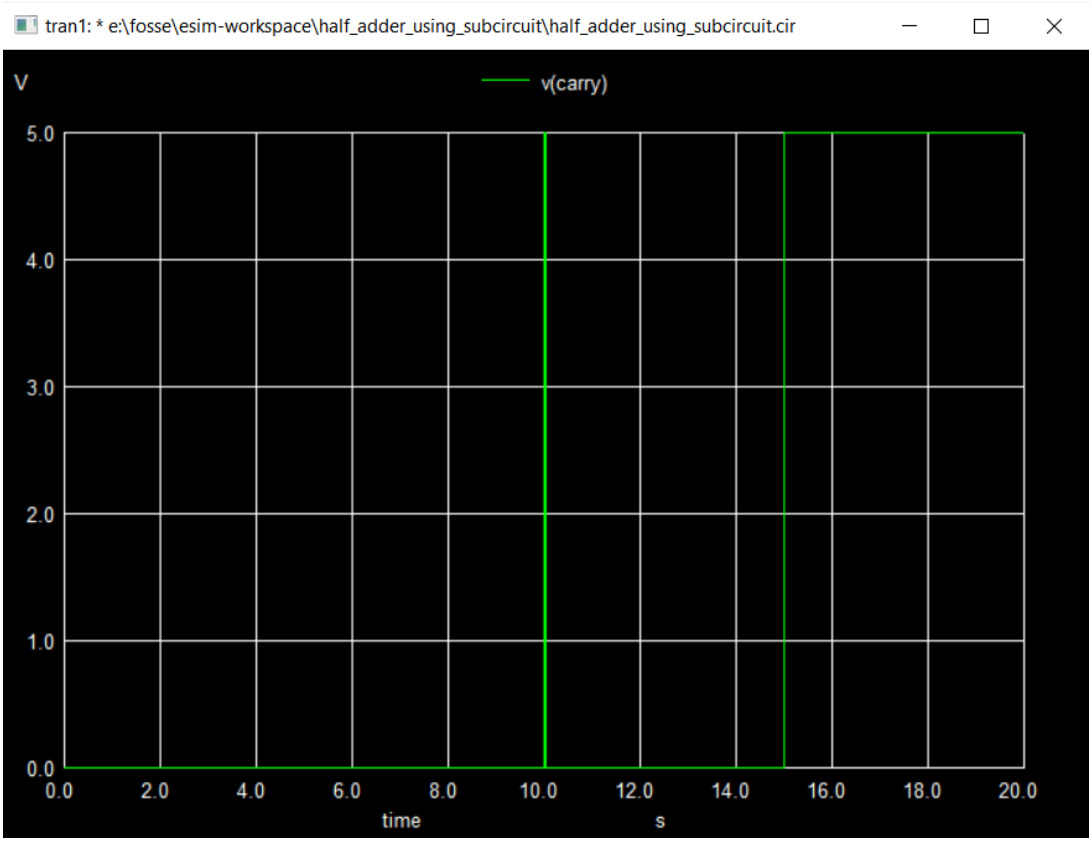


B

- Outputs: -

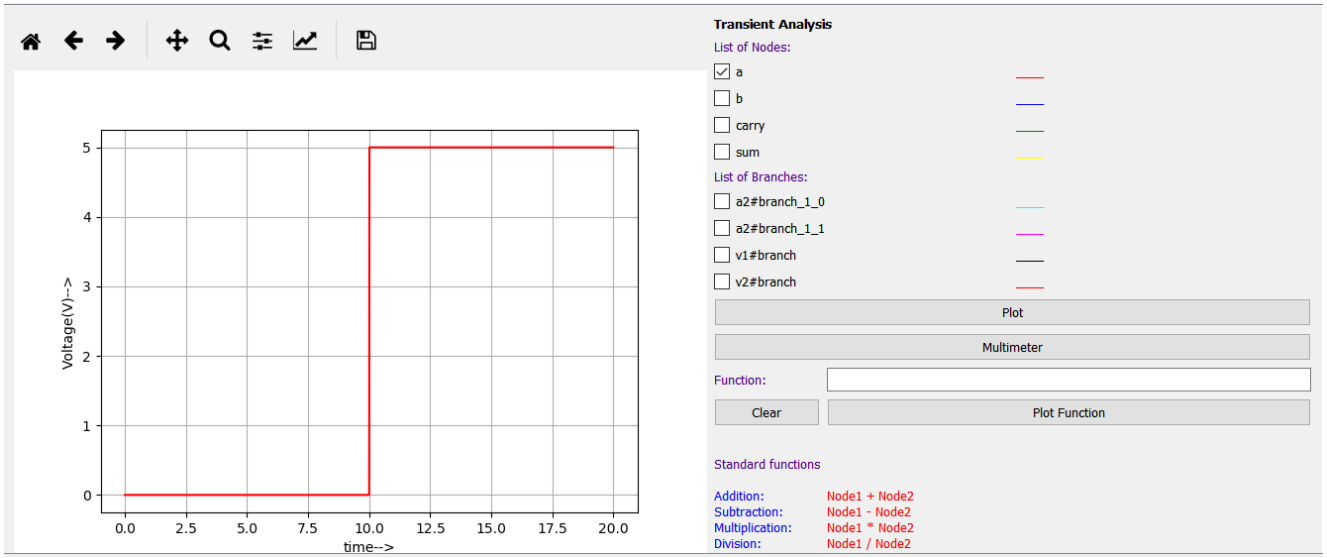


SUM

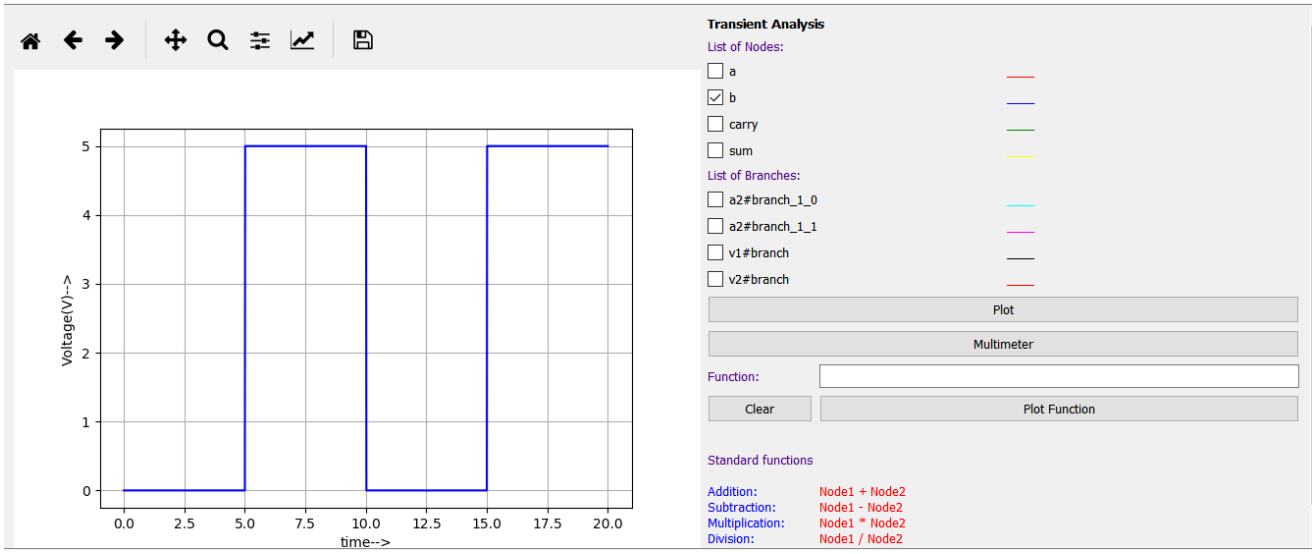


CARRY

- **Python Plots: -**
  - Inputs: -

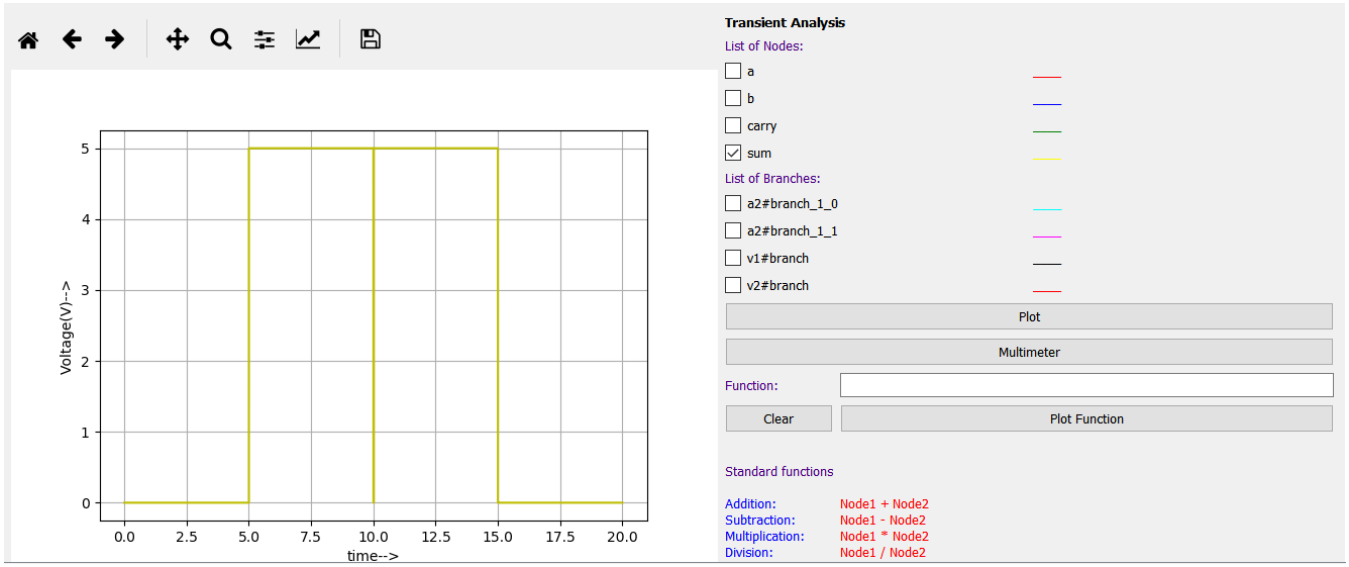


A

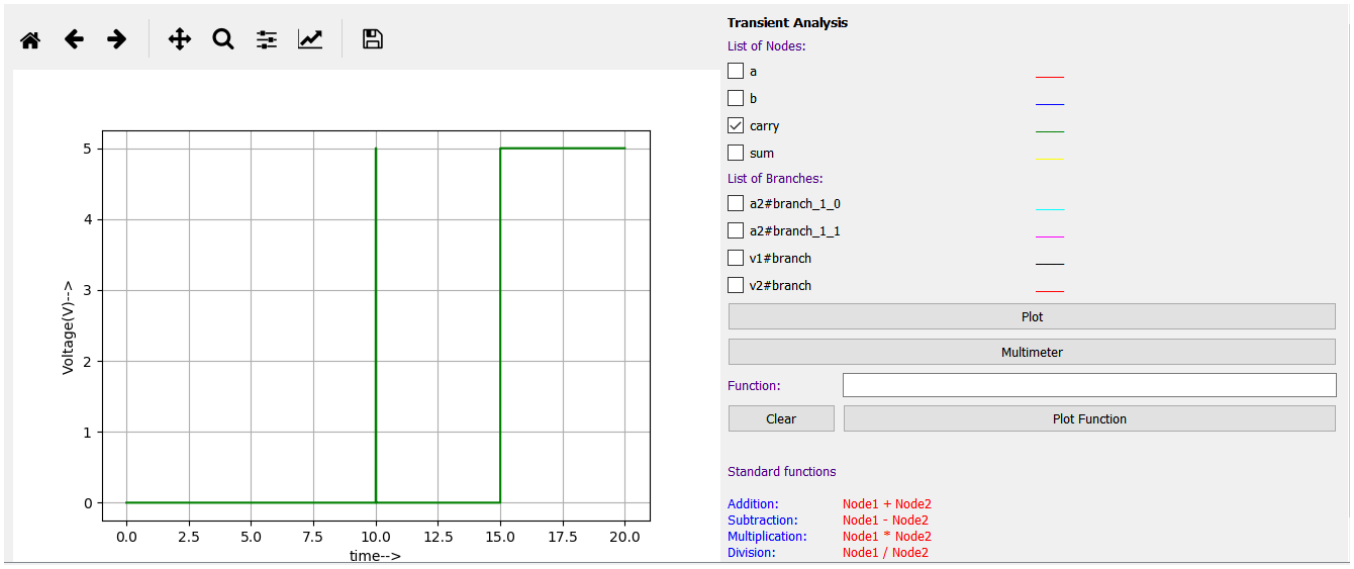


B

- Outputs: -



SUM



CARRY

References: -

- https://www.javatpoint.com/half-adder-in-digital-electronics
- https://www.circuitstoday.com/half-adder