Circuit Simulation Project

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

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Project Guide: Dr. Maheswari.R

Title of the circuit: Half Adder using NOR Gates

Theory/Description :

The half subtractor is also a building block for subtracting two binary numbers. It has two inputs and two outputs. This circuit is used to subtract two single bit binary numbers A and B. The **'diff'** and **'borrow'** are two output states of the half subtractor.

The SOP form of the **Diff** and **Borrow** is as follows:

Diff=A'B+AB'
Borrow = A'B

The **carry** and **sum** are the output states of the half subtractor. Total 5 NOR gates are required to implement half adder.

Truth Table:

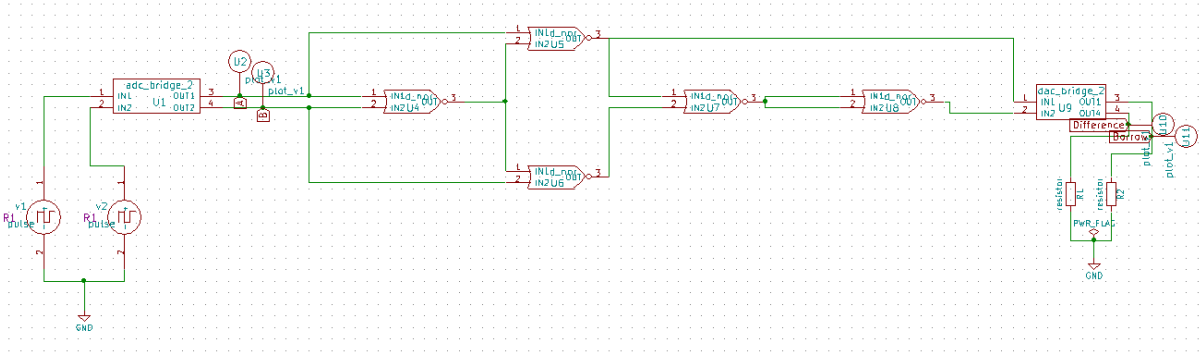
Inputs		Outputs	
A	**B**	**Diff**	**Borrow**
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

In the above table,

- 'A' and 'B' are the input variables whose values are going to be subtracted.

- The 'Diff' and 'Borrow' are the variables whose values define the subtraction result, i.e., difference and borrow.
- The first two rows and the last row, the difference is 1, but the 'Borrow' variable is 0.
- The third row is different from the remaining one. When we subtract the bit 1 from the bit 0, the borrow bit is produced.

Circuit Diagram(s) :



Results (Input, Output waveforms and/or Multimeter readings) :

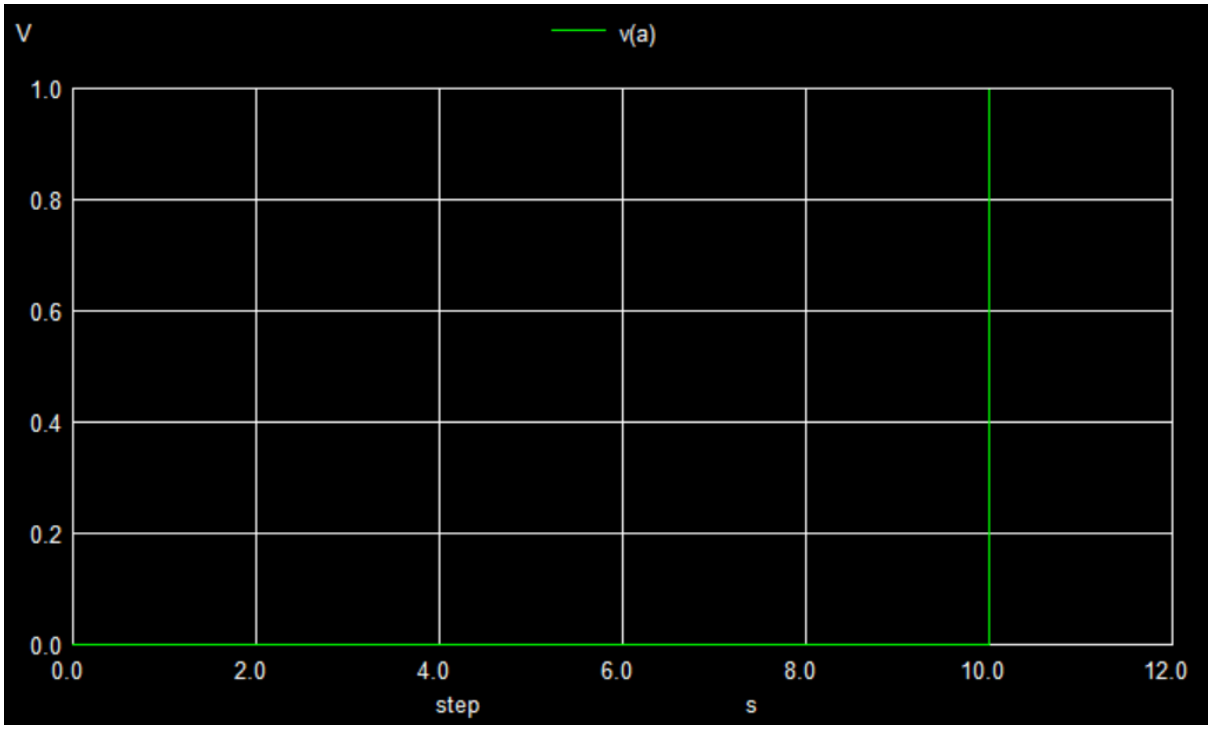


Fig. 2a: Analog signal for A

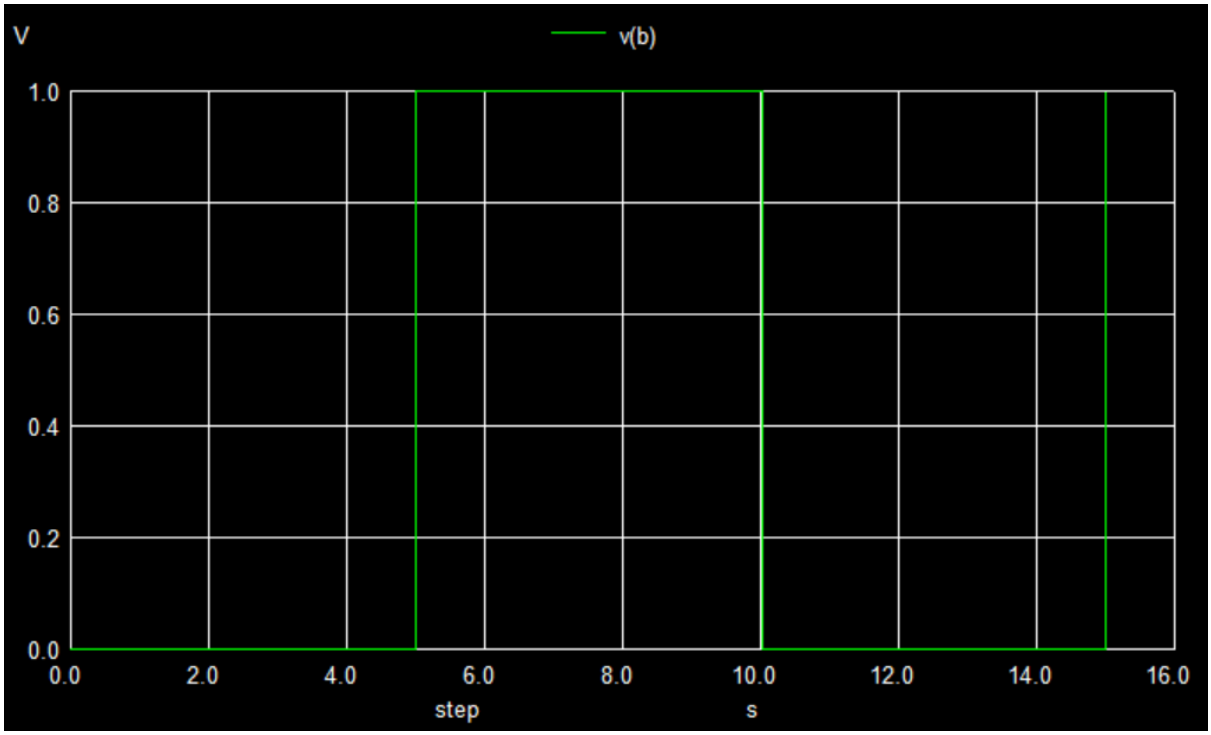


Fig. 2b: Analog signal for B

Figures 2a trough 2b show the analog signals for each of the input bits.

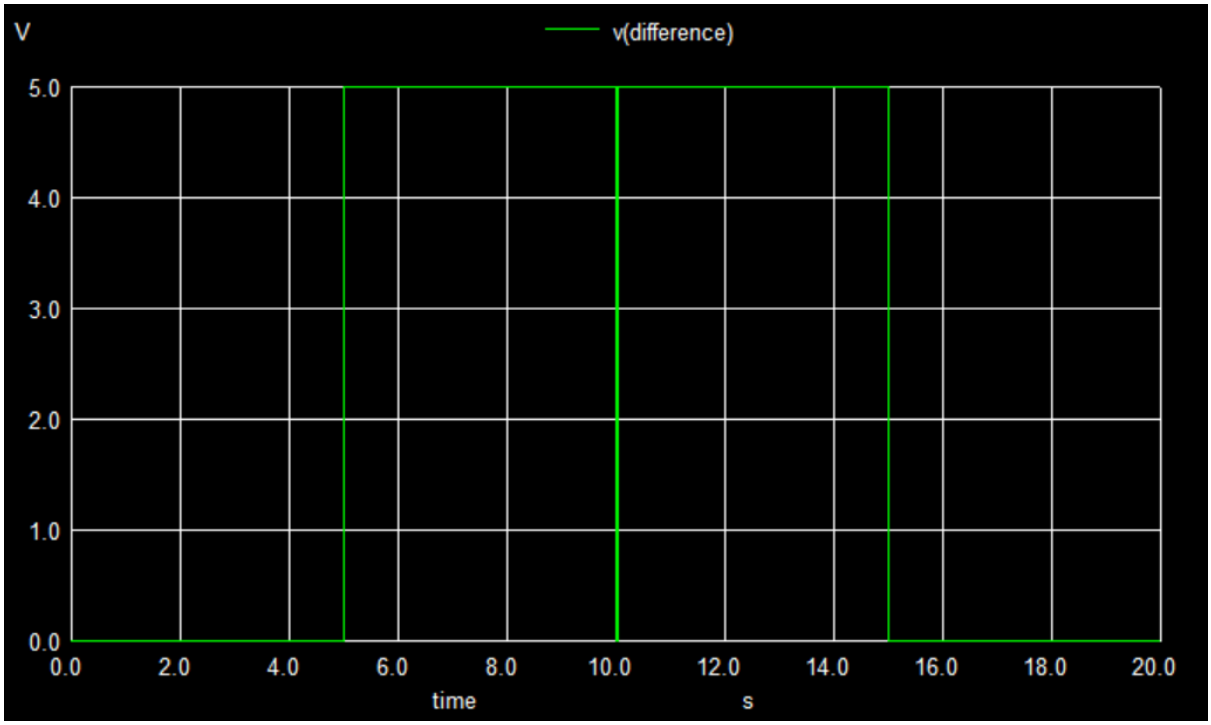


Fig. 3a: Analog signal for Difference

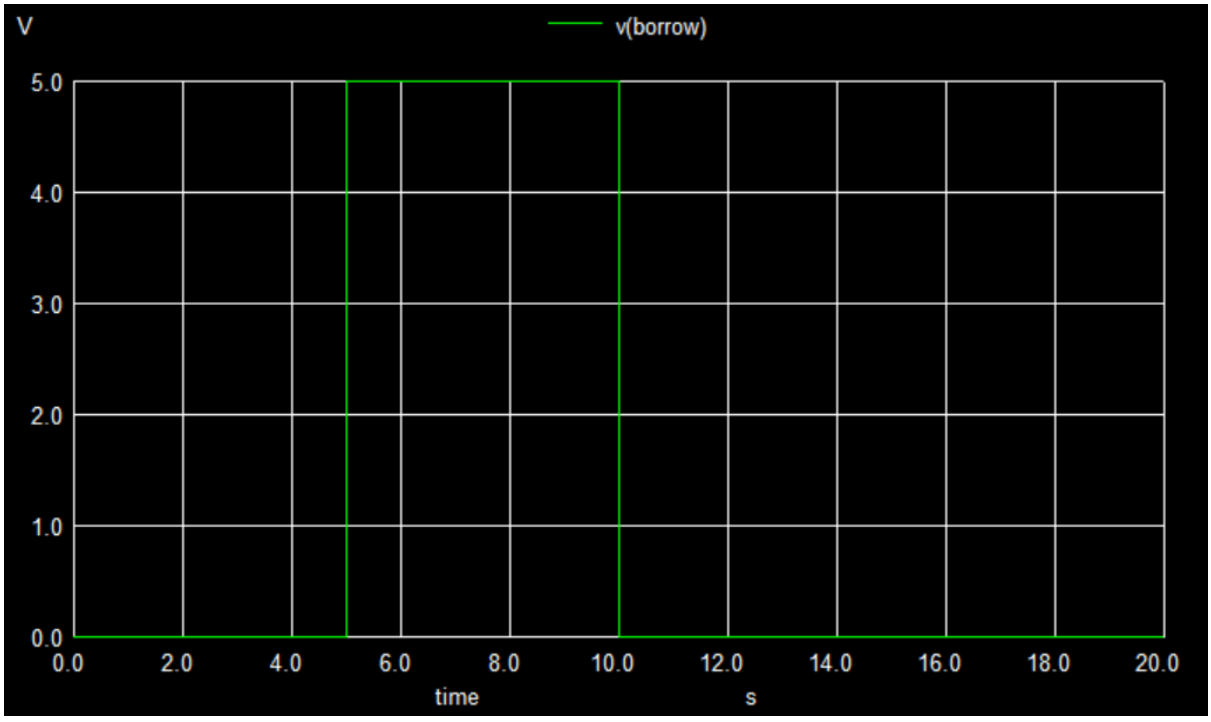


Fig. 3b: Analog signal for Borrow

Figures 3a through 3b display show the output analog signals for each of the output bits.

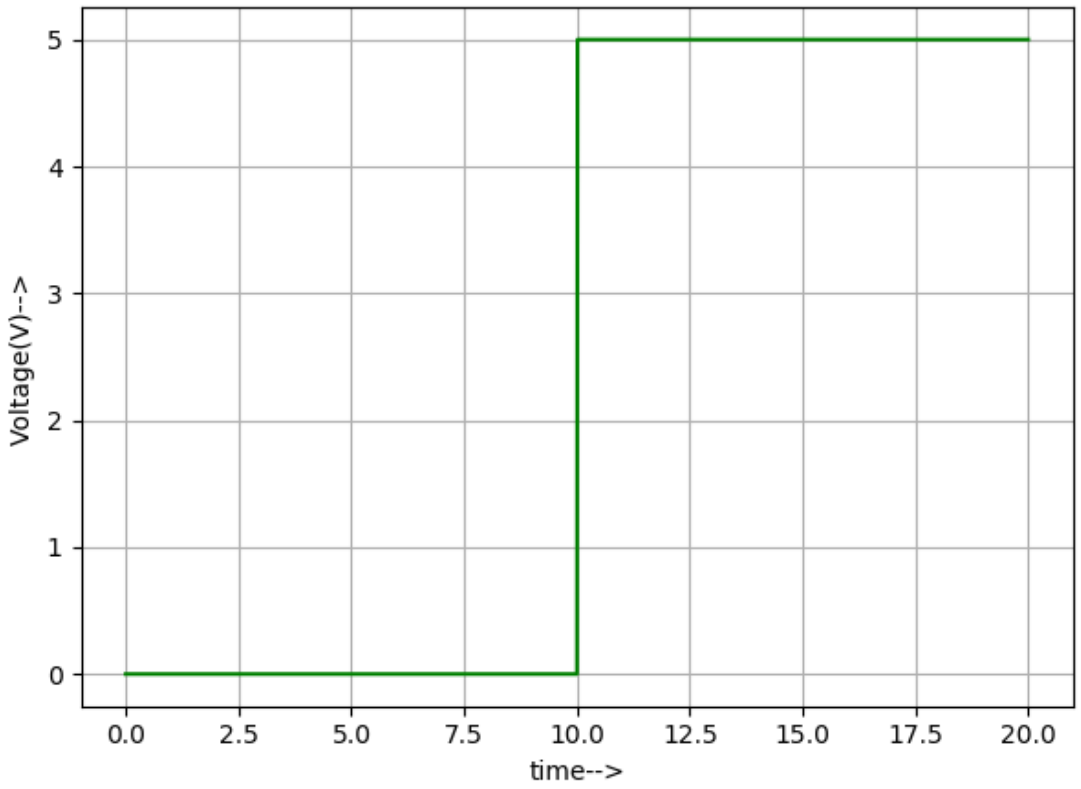


Fig. 4a: Python plot for A

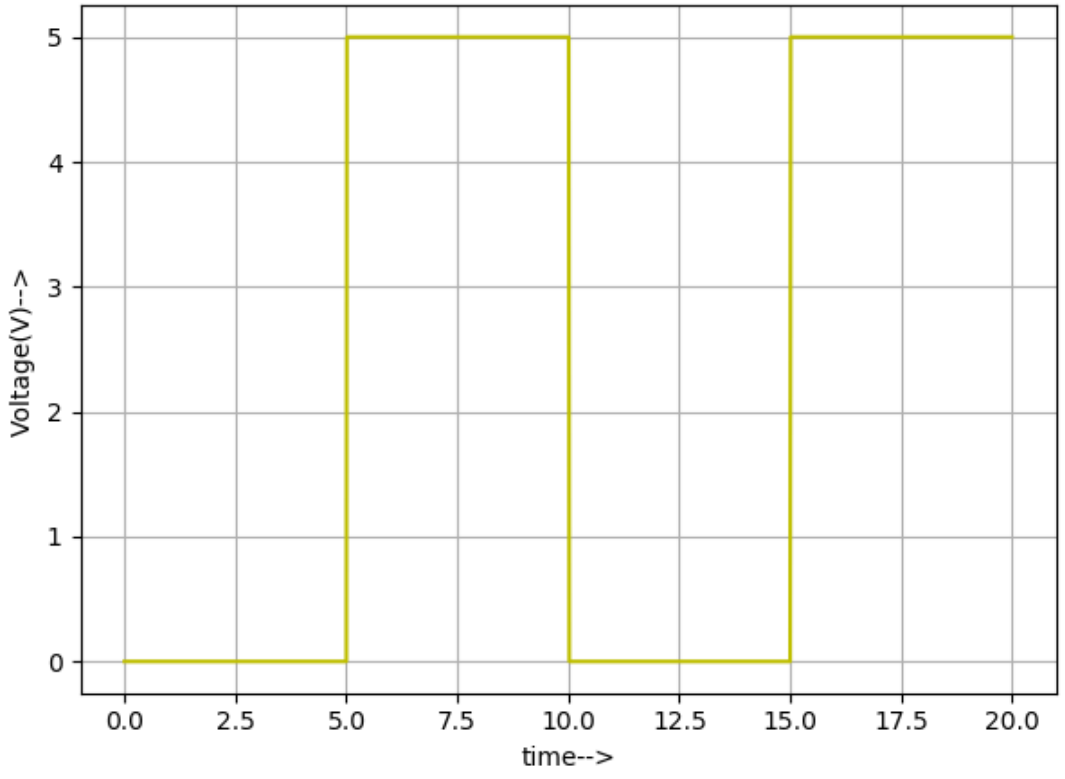


Fig. 4b: Python plot for B

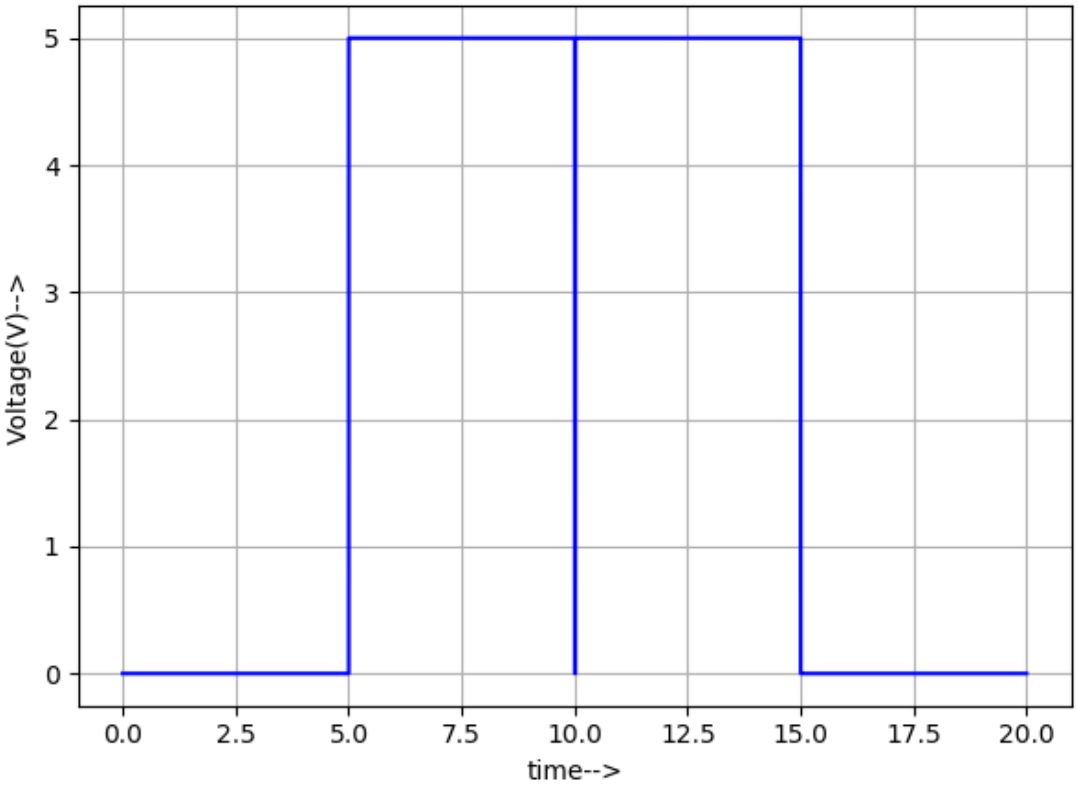


Fig. 4c: Python plot for Difference

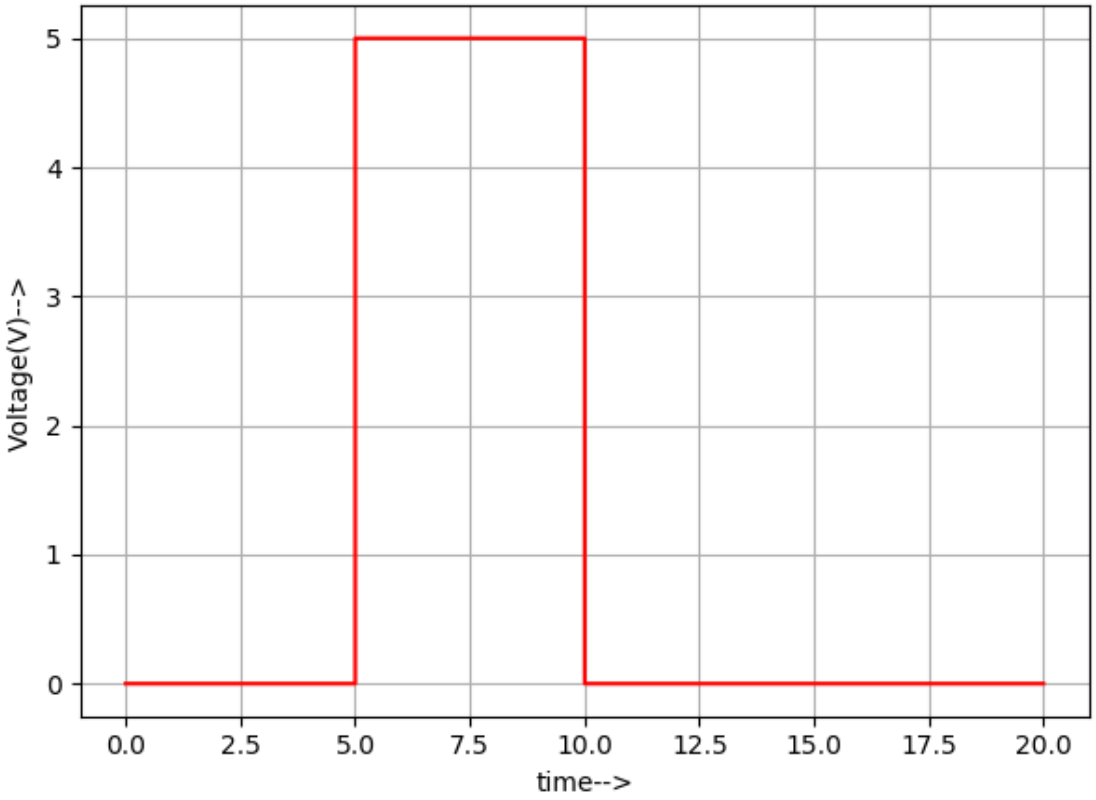


Fig. 4d: Python plot for Borrow

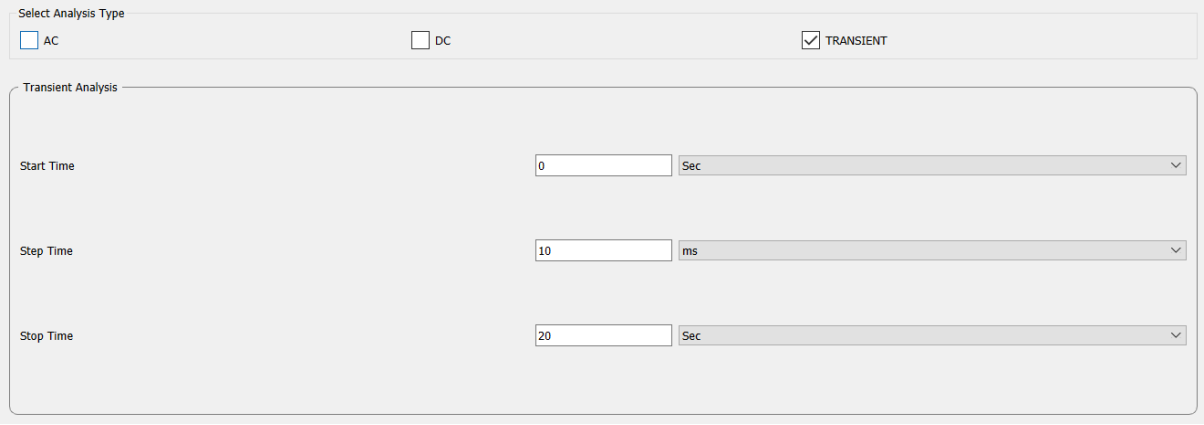
Simulation parameter for reference:

Add parameters for pulse source v1

Enter initial value(Volts/Amps):	0
Enter pulsed value(Volts/Amps):	5
Enter delay time (seconds):	10
Enter rise time (seconds):	0
Enter fall time (seconds):	0
Enter pulse width (seconds):	10
Enter period (seconds):	20

Add parameters for pulse source v2

Enter initial value(Volts/Amps):	0
Enter pulsed value(Volts/Amps):	5
Enter delay time (seconds):	5
Enter rise time (seconds):	0
Enter fall time (seconds):	0
Enter pulse width (seconds):	5
Enter period (seconds):	10



Source/Reference(s) :

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

https://www.geeksforgeeks.org/half-adder-half-subtractor-using-nand-nor-gates/

(Half Adder using NOR Gates)