Circuit Simulation Project

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

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Project Guide: Dr R. Maheshwari

Title of the Circuit: 4-Bit MOD-6 Counter using JK Flip Flop

Description:

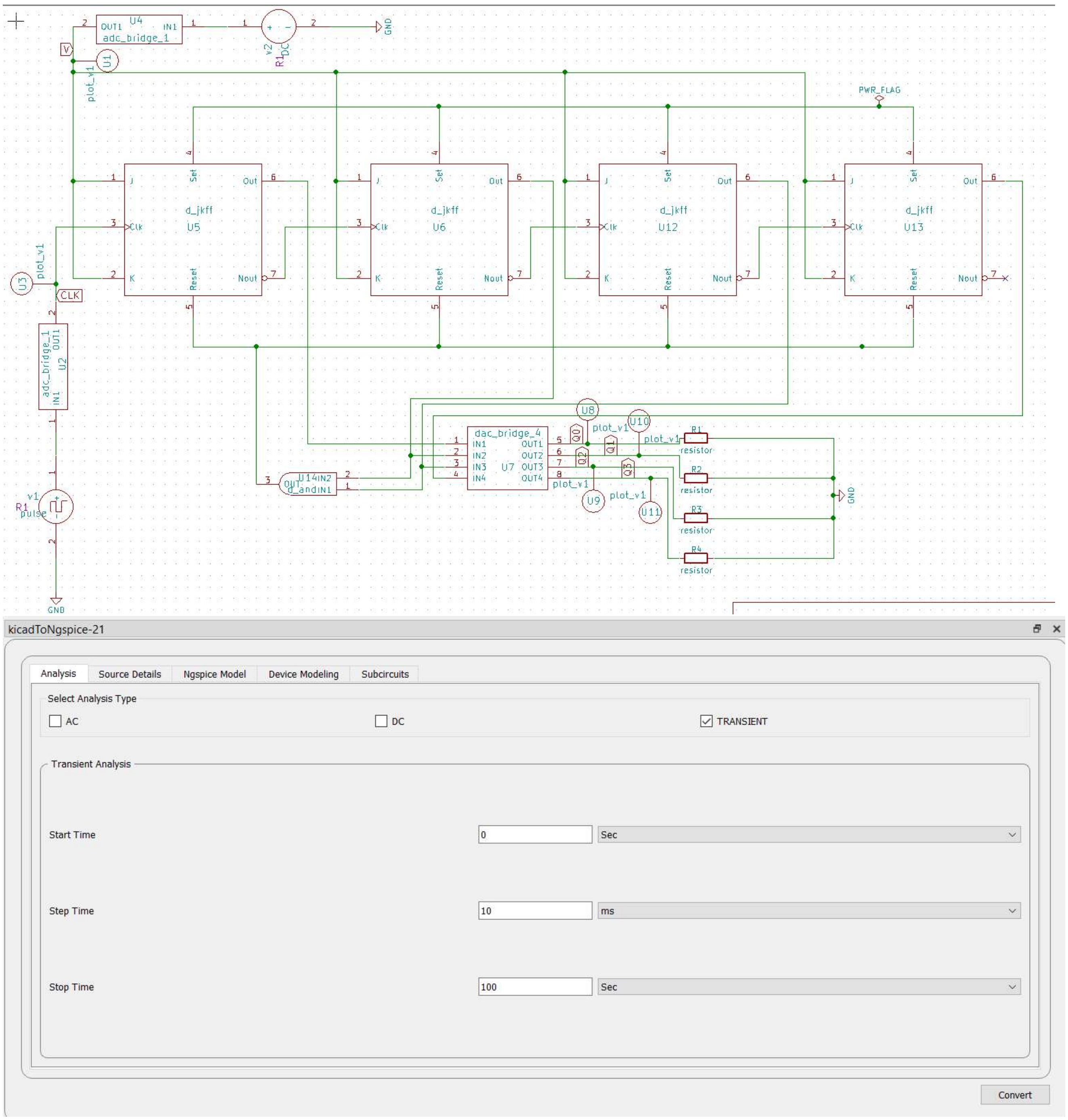
A counter is a sequential logic circuit that goes through a prescribed sequence of states upon the application of input pulses. The prescribed sequence can be a binary sequence or any other sequence. A counter that goes through 2N (N is the number of flip-flops in the series) states is called a binary counter. The modulus of a counter is the number of different states it is allowed to have. Counter modulus is normally 2N unless controlled by a feedback circuit which limits the number of possible states (an example being the decimal counter). Counters are very widely used in almost all computers and other digital electronic systems. There are two major categories of counters:

- Asynchronous counters
- Synchronous counters.

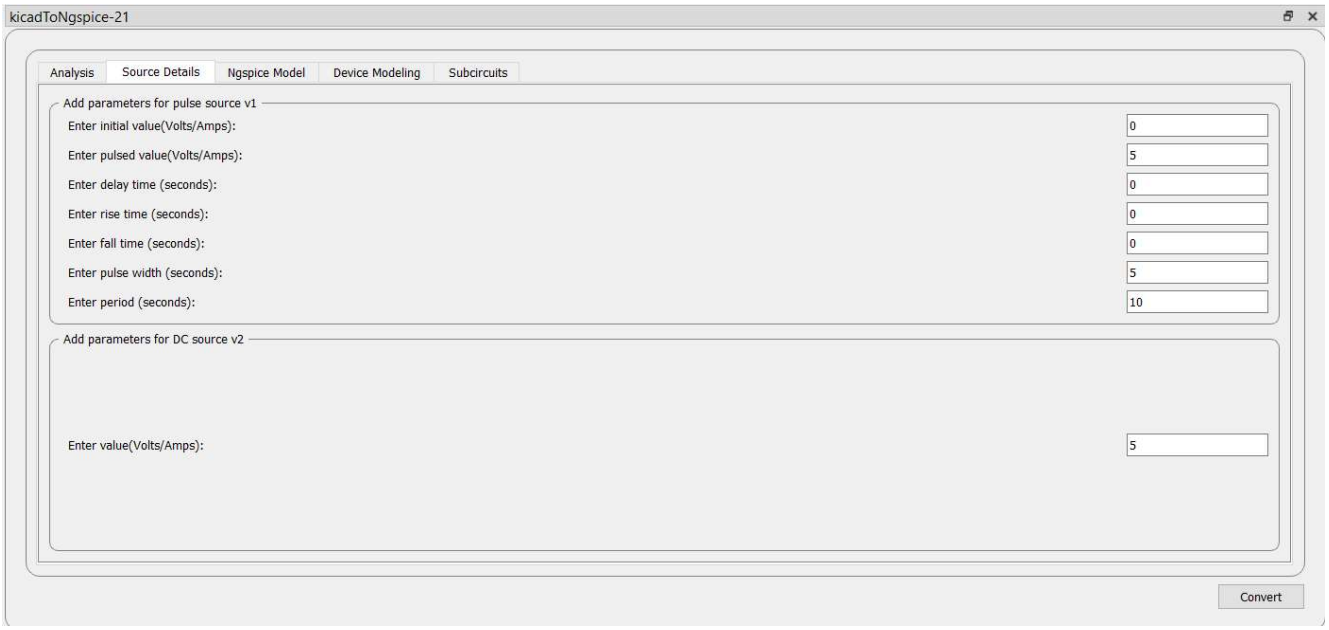
Asynchronous counter can count using Asynchronous clock input. Counters can be easily made using flipflops.

As the count depends on the clock signal, in case of an Asynchronous counter, changing state bits are provided as the clock signal to the subsequent flip-flops. Those Flip-flops are serially connected together and the clock pulse ripples through the counter. Due to the ripple clock pulse, it's often called a ripple counter. An Asynchronous counter can count 2n - 1 possible counting states.

A MOD-6 counter is a ripple counter that counts from 0 to 5, then resets and starts from 0 again.



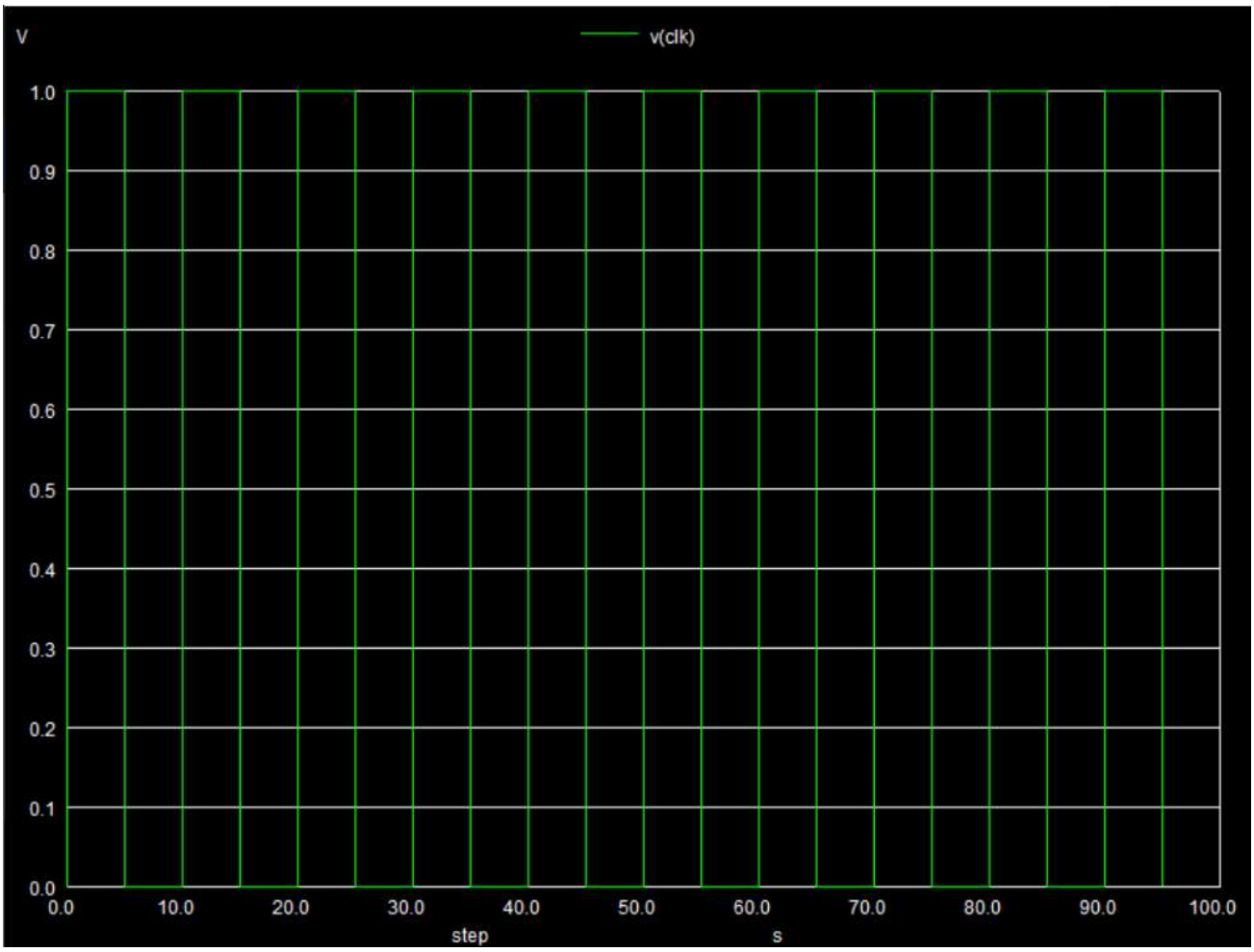
adc_bridge_1
U4
GND
PWR_FLAG
d_jkff
U5
U6
U12
U13
plot_v1
CLK
U2
v1
pulse
dac_bridge_4
U7
U14
d_and
resistor
R1
R2
R3
R4
kicadToNgspice-21
Analysis
Source Details
Ngspice Model
Device Modeling
Subcircuits
Select Analysis Type
AC
DC
TRANSIENT
Transient Analysis
Start Time
0
Sec
Step Time
10
ms
Stop Time
100
Sec
Convert



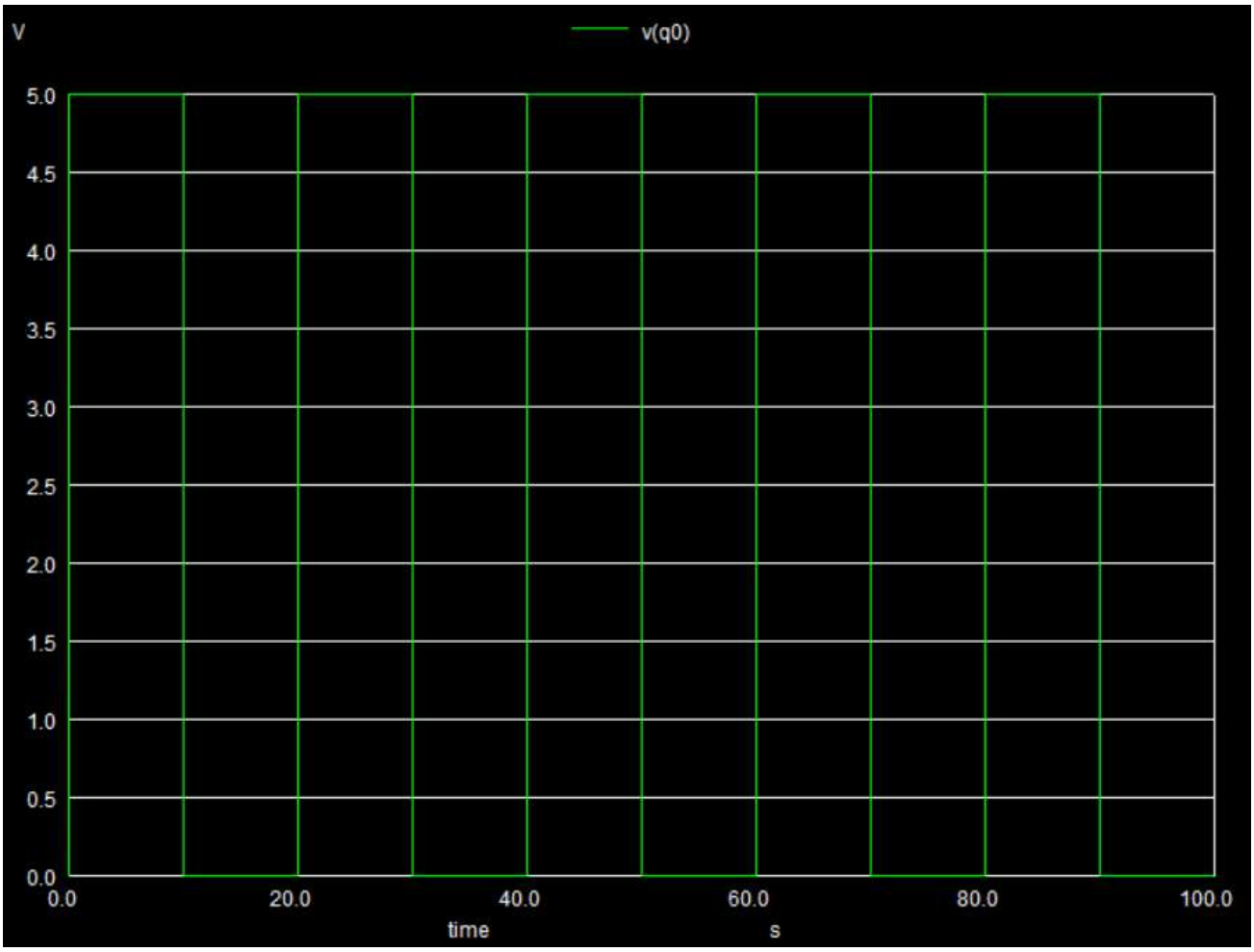
Simulation results:

1.NgSpice Waveforms

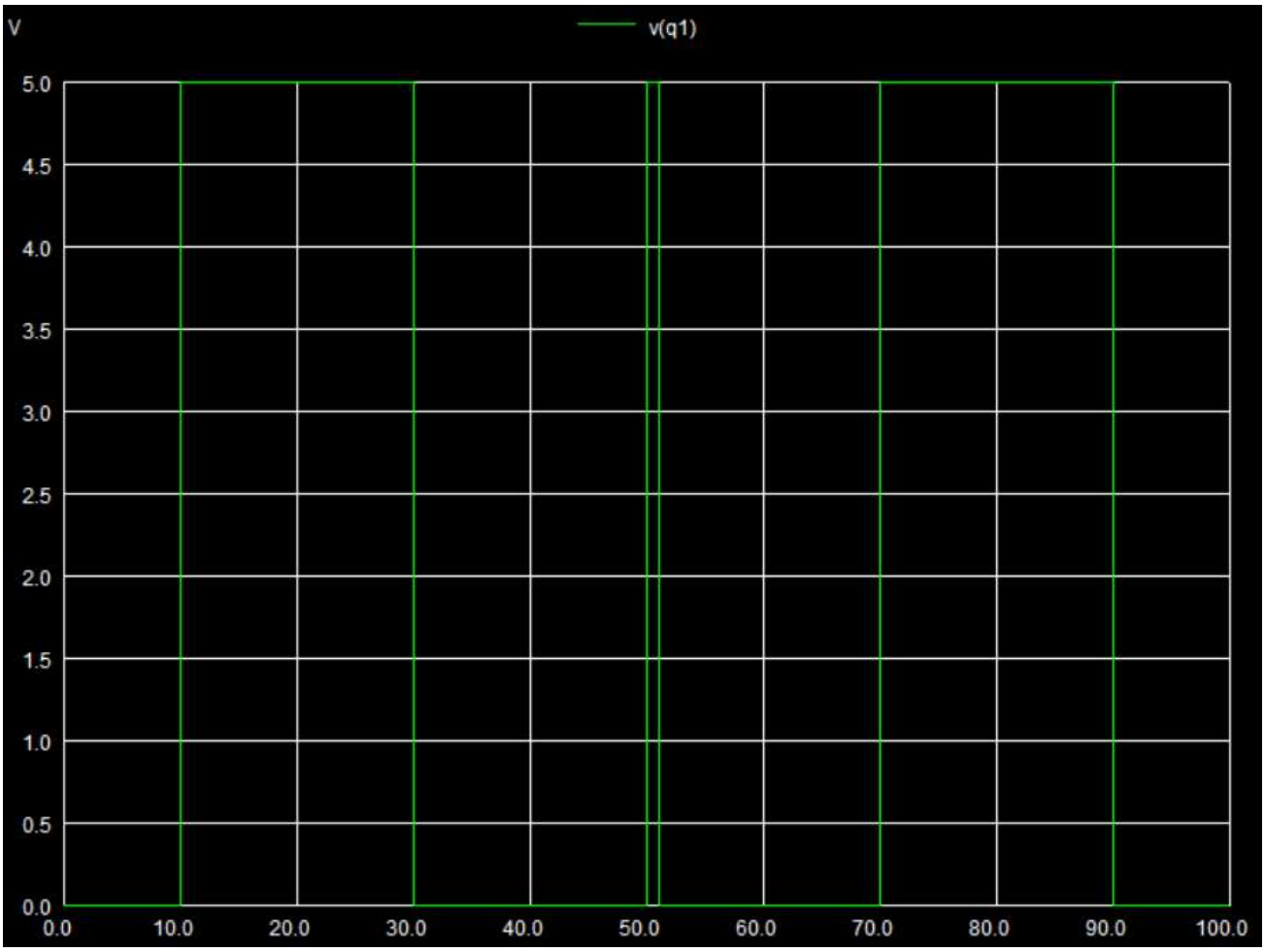
CLOCK Pulse:


V
v(clk)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
step
s

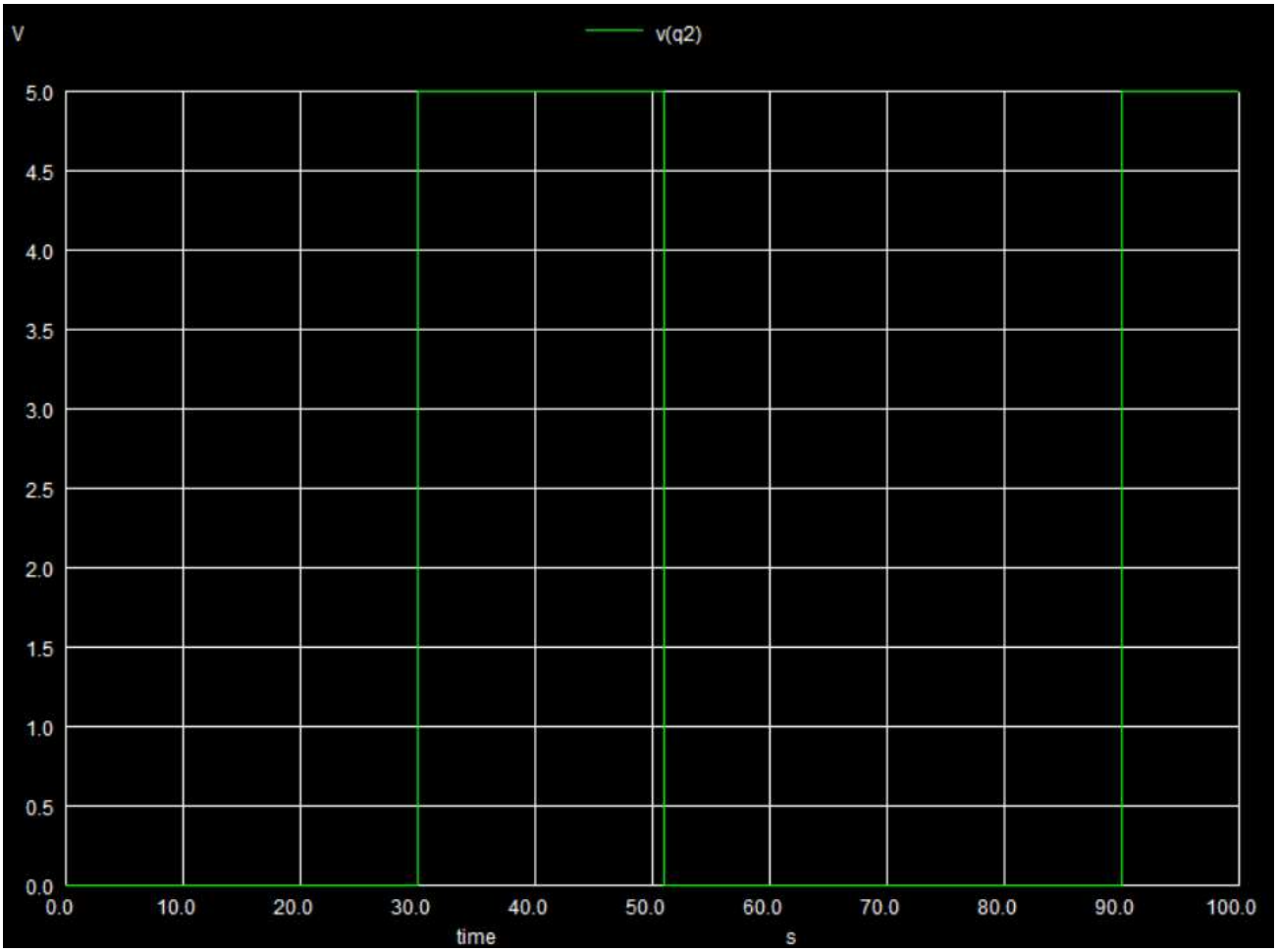
Q0(LSB):



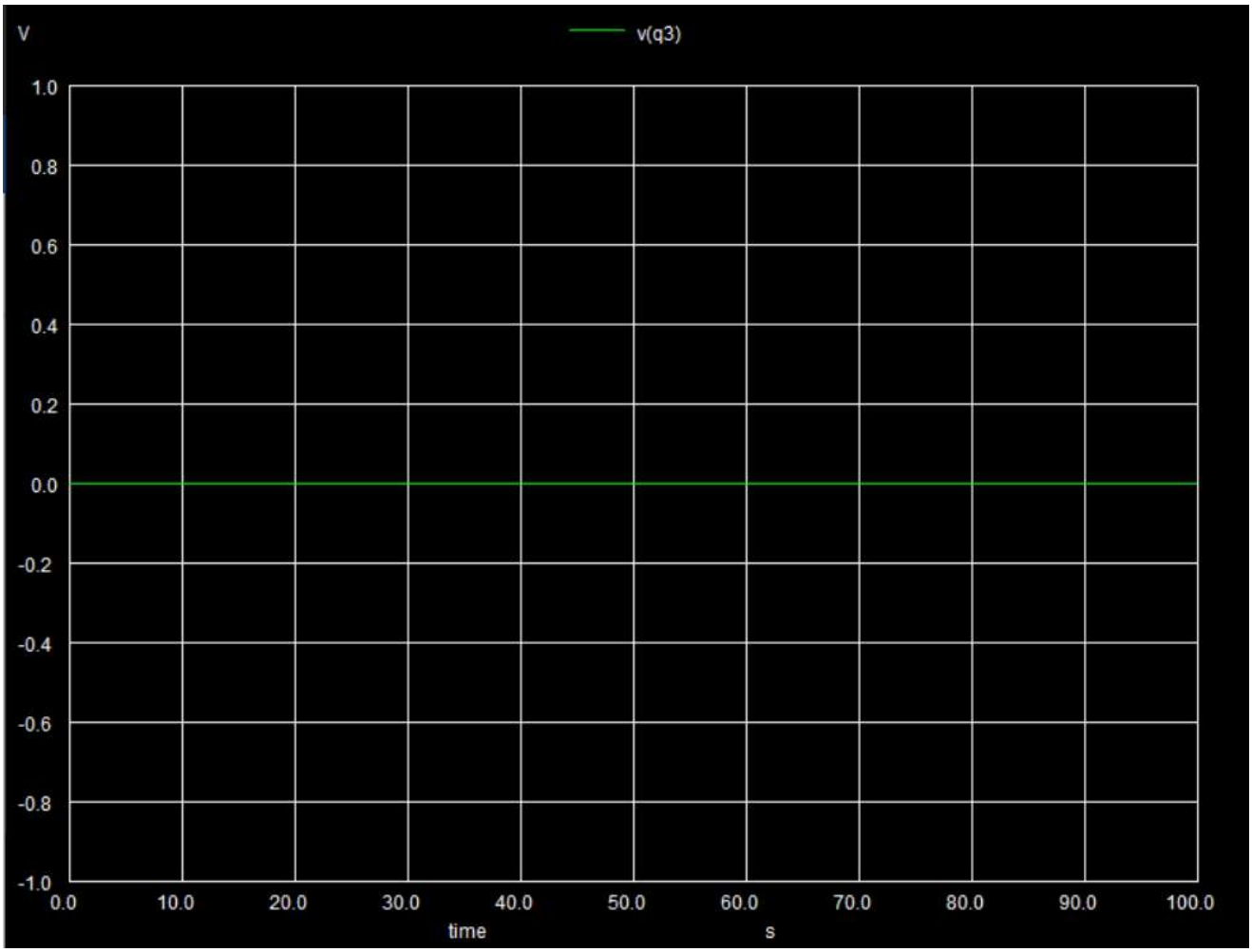
Q1:


V
v(q1)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0

Q2:

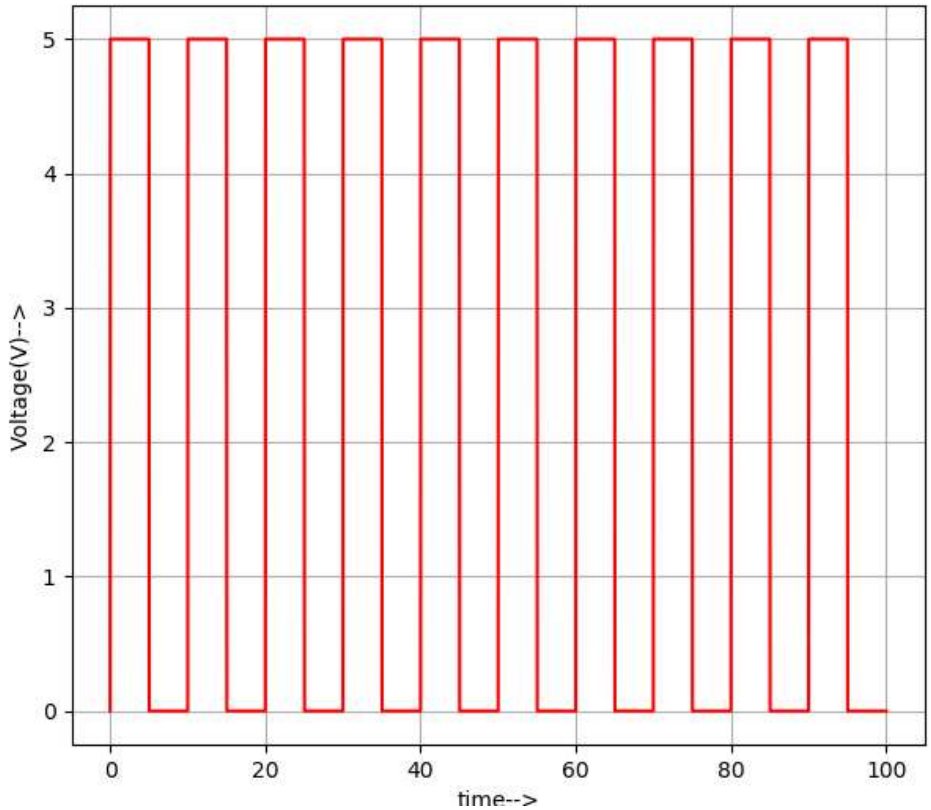

V
v(q2)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
time
s

Q3(MSB):

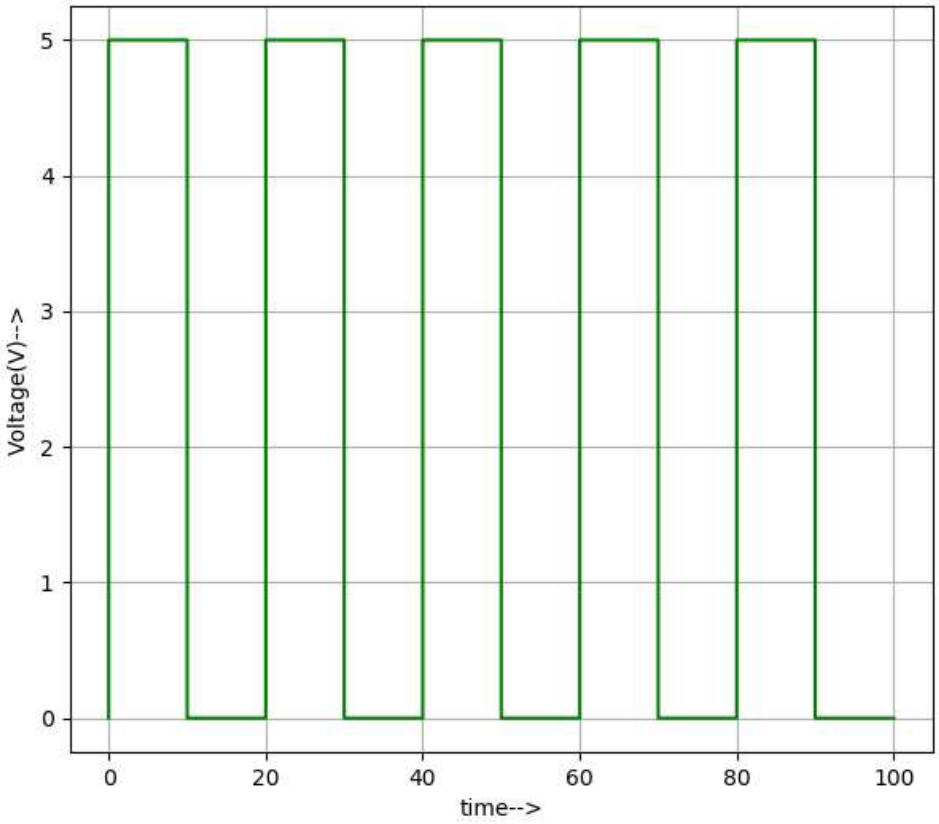


2.Python Waveform

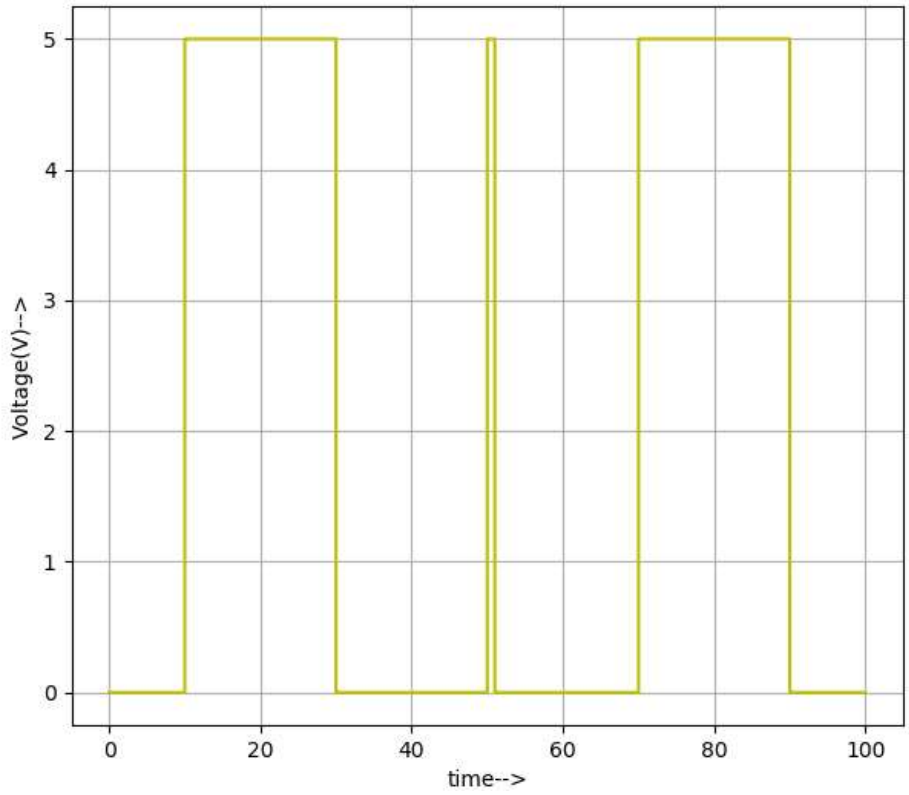
CLOCK Pulse:



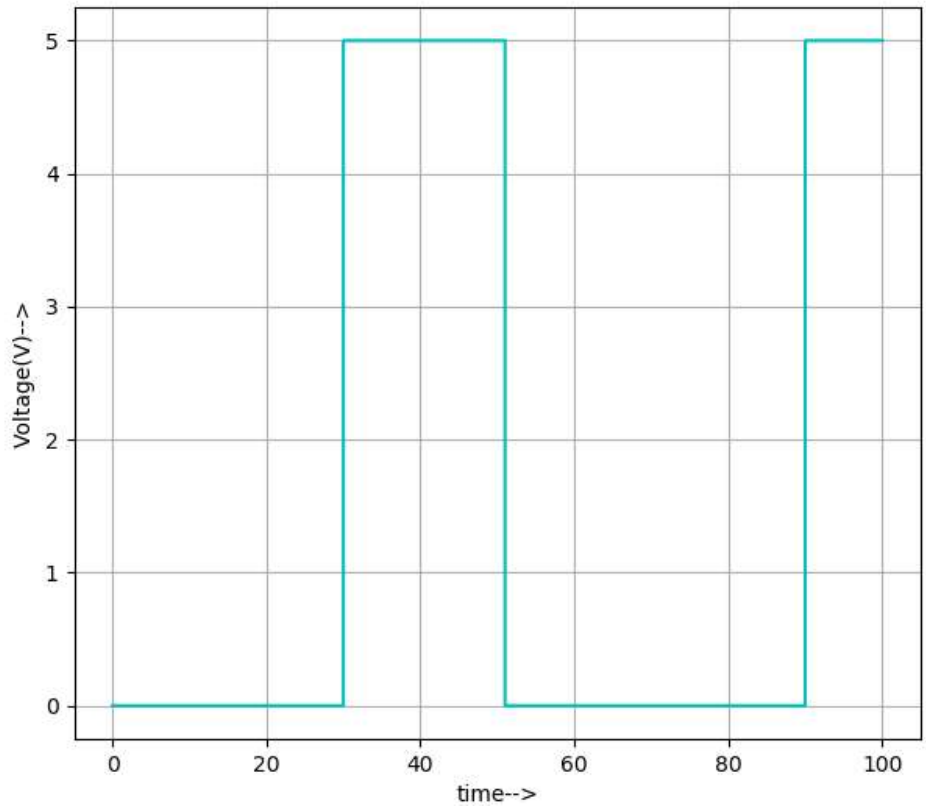
Q0(LSB):



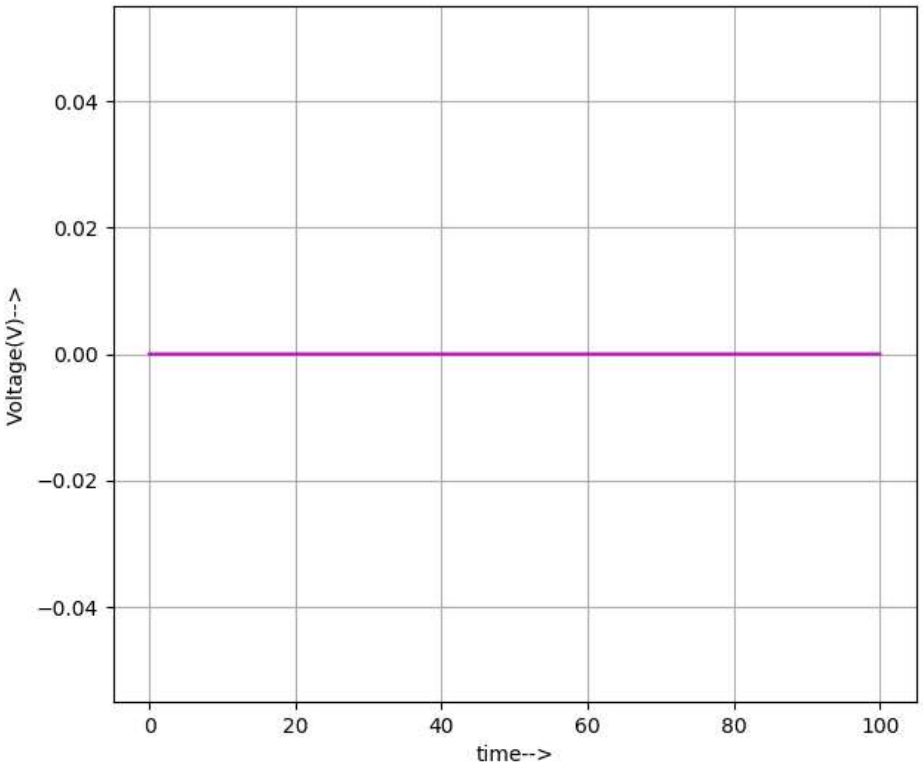
Q1:


Voltage(V)-->
time-->
0
1
2
3
4
5
0
20
40
60
80
100

Q2:


Voltage(V)-->
time-->
0
1
2
3
4
5
0
20
40
60
80
100

Q3(MSB):



REFERENCES:

https://electronics-course.com/truncated-ripple-counter