Generation Of Pn Sequence With Internal 555 Timer Based Clock Using eSim and SKY130

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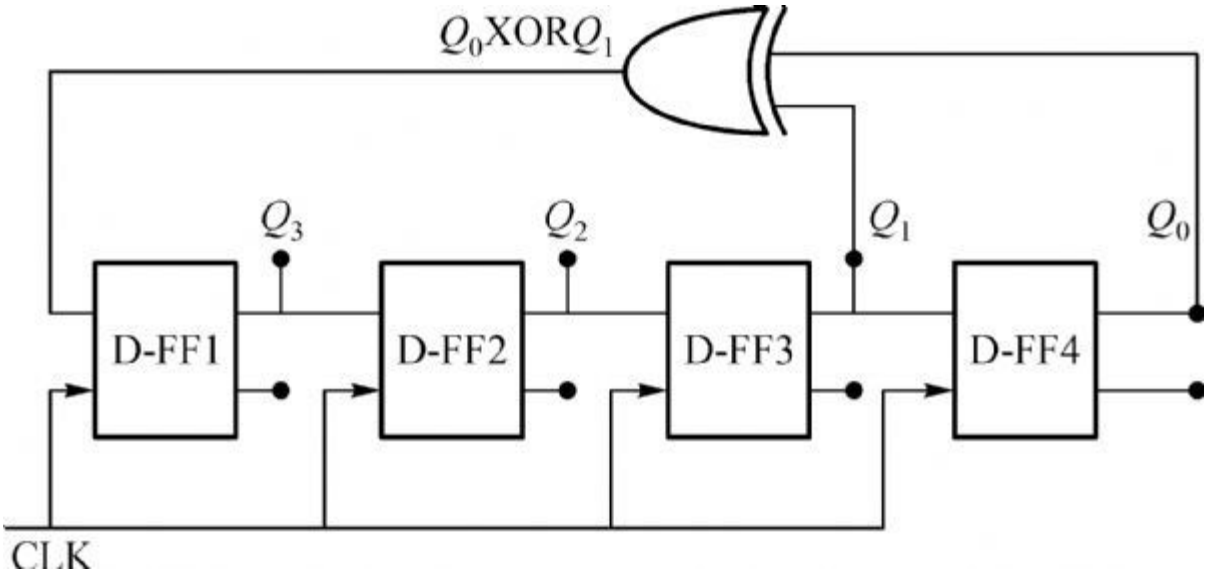
Abstract:

This project focuses on the generation of Pseudo-Noise (PN) sequences utilizing an internal 555 timer-based clock system, implemented through eSim simulation software and SKY Water 130 nm technology. PN sequences play a crucial role in various communication and digital signal processing applications, including spread spectrum communication, encryption, and channel estimation. The proposed approach leverages the versatility of the 555 timer IC, a widely-used integrated circuit for timing applications, to generate PN sequences efficiently.

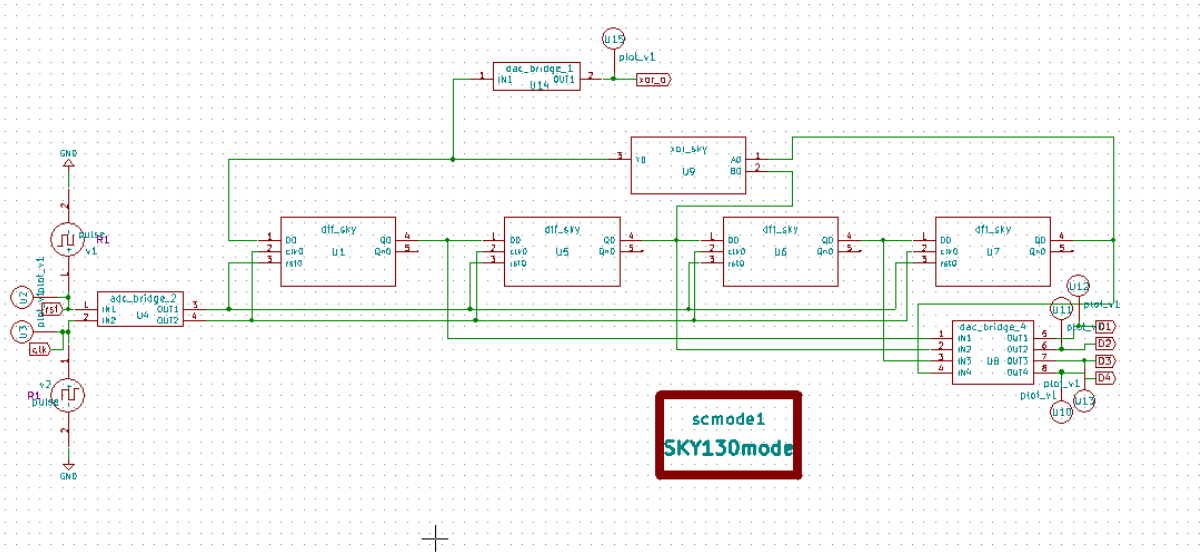
Circuit details:

Clock generator like 555 timer will generate clock pulses 4 D Flip Flop are connected with output of 3rd and 4th flip flop is xor and feed it back to 1st flipflop. The output is generated at Q0, Q1, Q2, Q3 as D4, D3, D2, D1. The circuit continuously generate pseudo-noise.

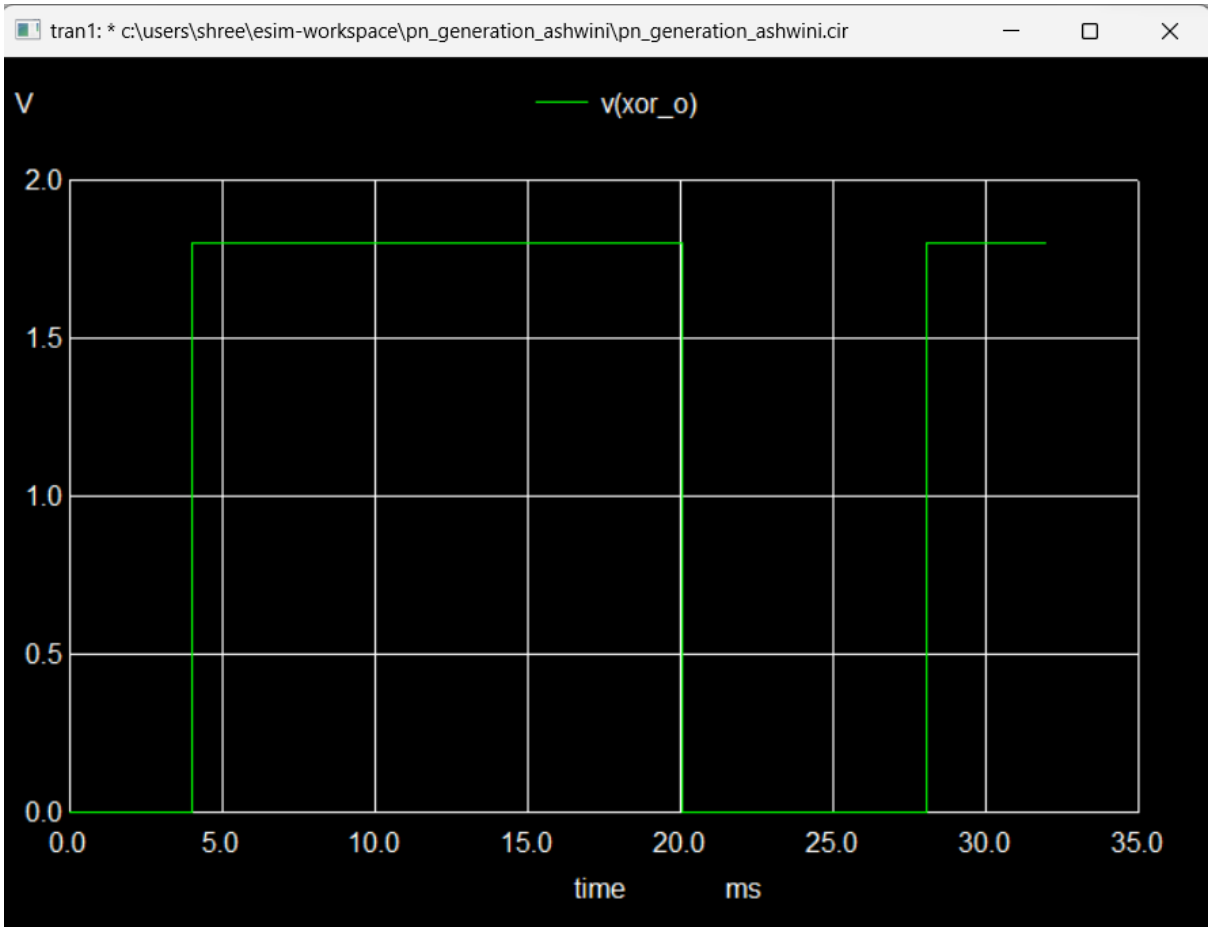
Circuit Diagram:

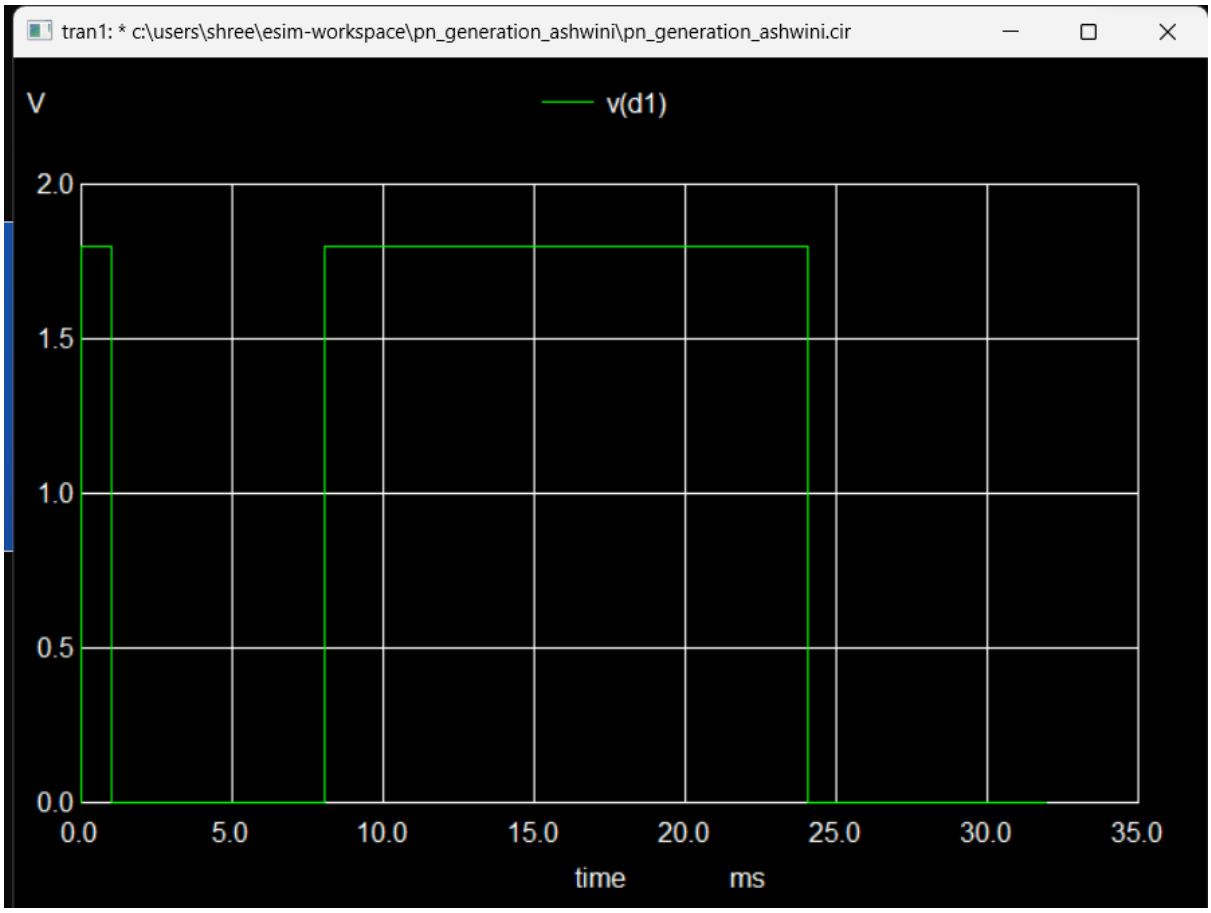


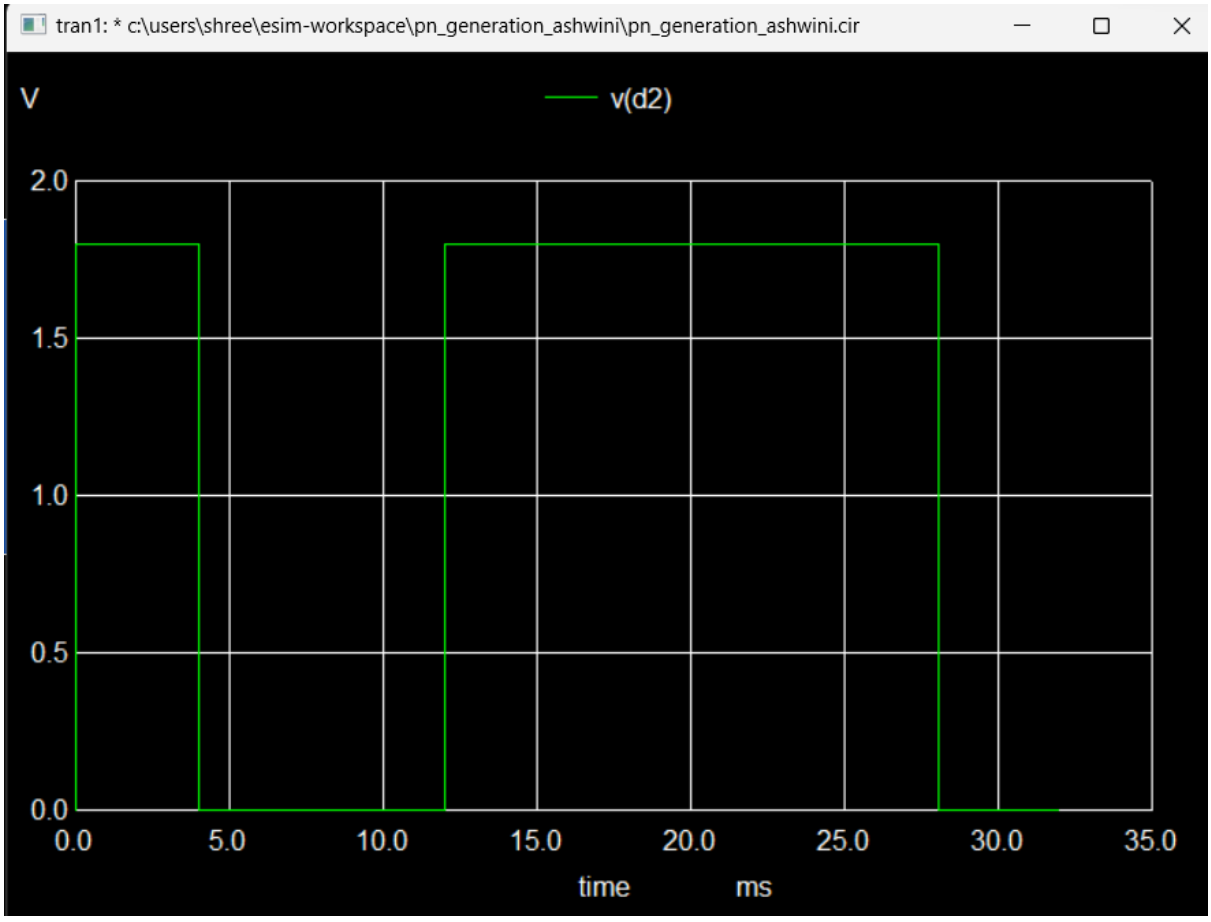
Circuit Diagram eSim:

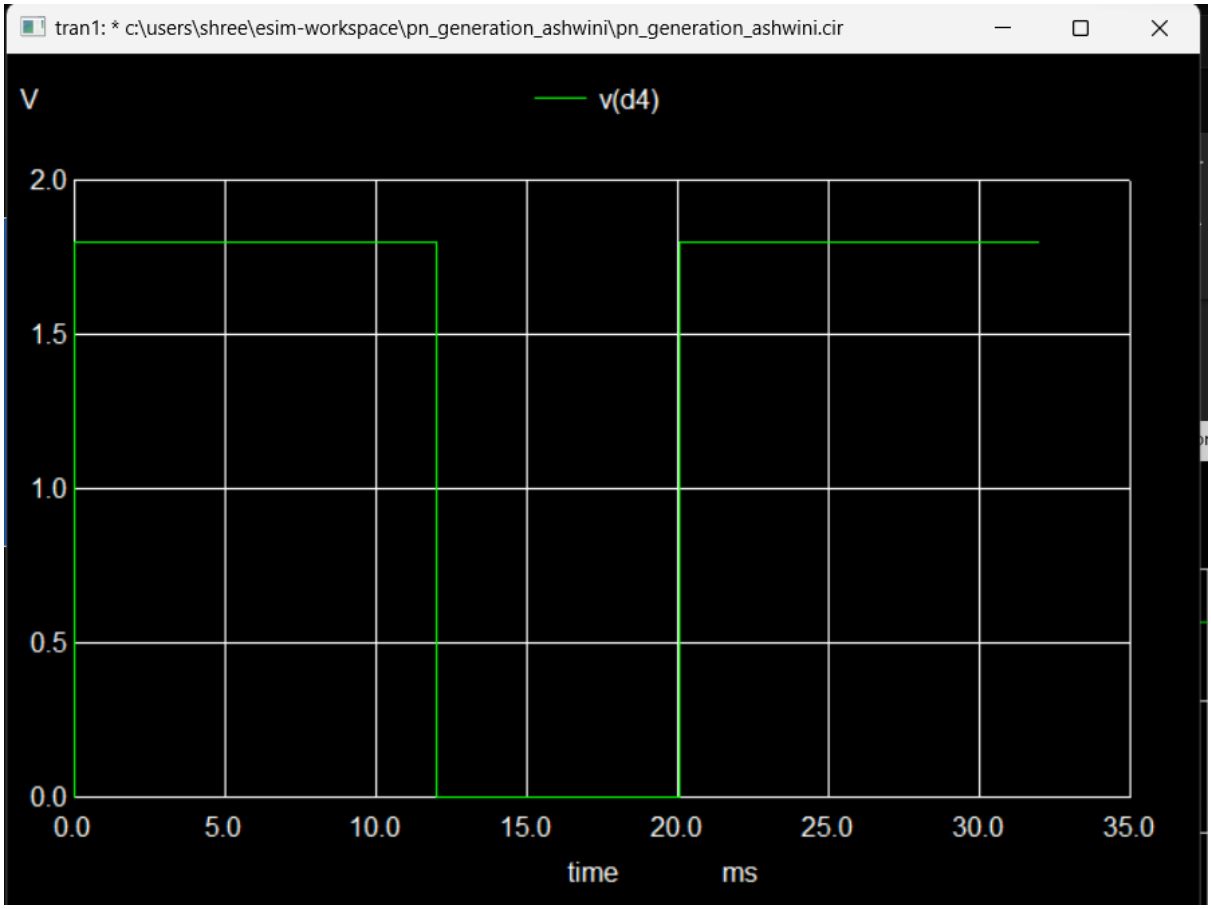


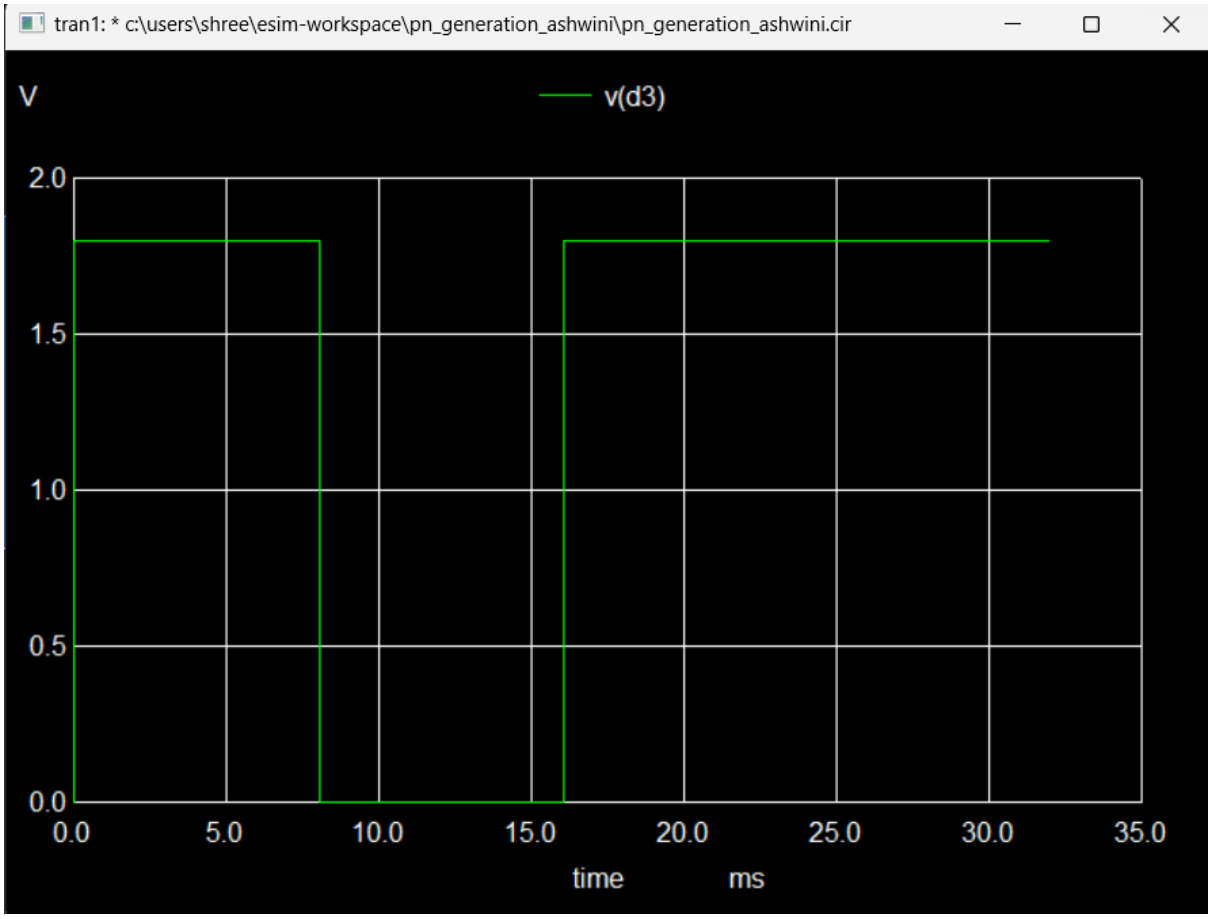
Results:

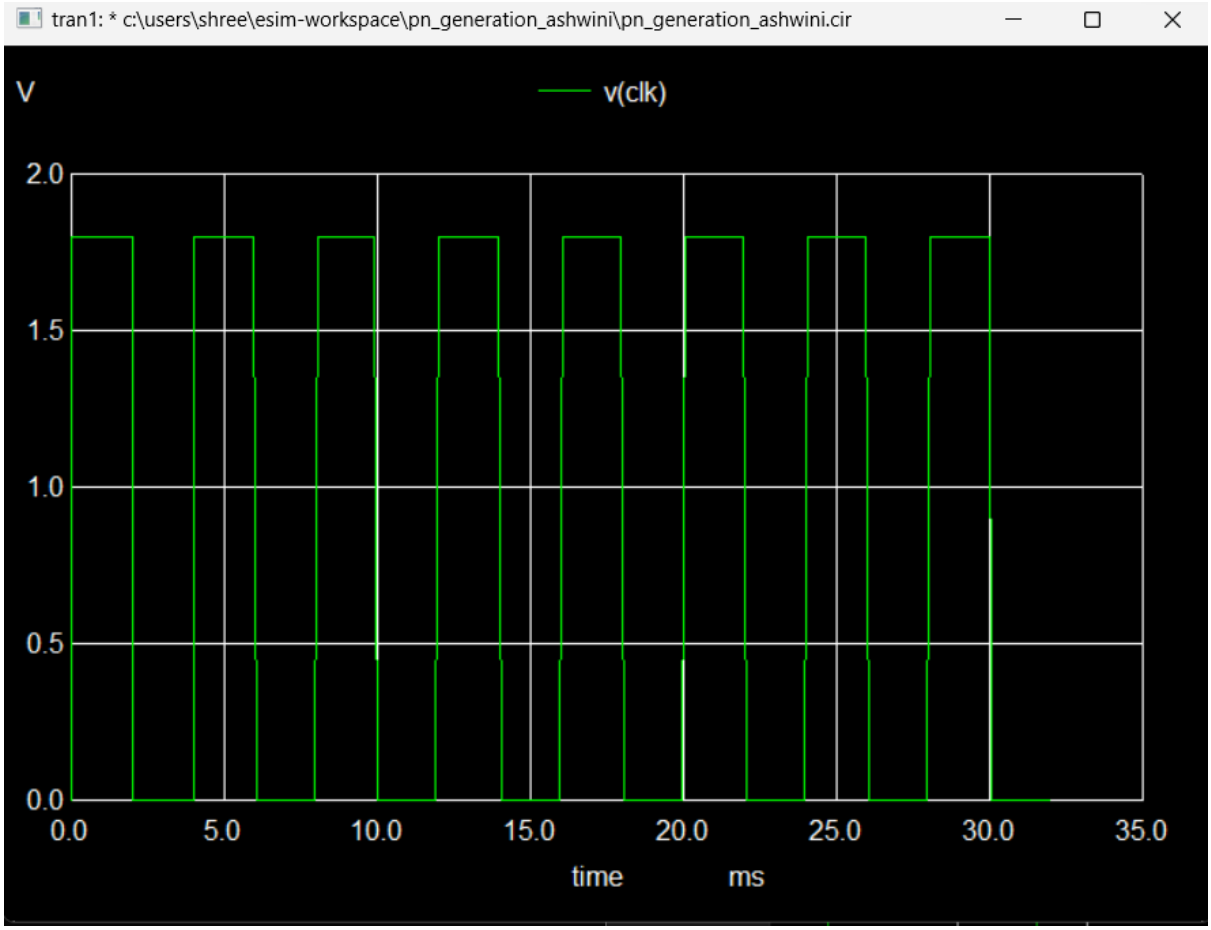



tran1: * c:\users\shree\esim-workspace\pn_generation_ashwini\pn_generation_ashwini.cir
V
v(d1)
2.0
1.5
1.0
0.5
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
time
ms


tran1: * c:\users\shree\esim-workspace\pn_generation_ashwini\pn_generation_ashwini.cir
V
v(d2)
2.0
1.5
1.0
0.5
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
time
ms


tran1: * c:\users\shree\esim-workspace\pn_generation_ashwini\pn_generation_ashwini.cir
V
v(d4)
2.0
1.5
1.0
0.5
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
time
ms


tran1: * c:\users\shree\esim-workspace\pn_generation_ashwini\pn_generation_ashwini.cir
V
v(d3)
2.0
1.5
1.0
0.5
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
time
ms



References:

[1] Linear Integrated Circuit by D ROY CHOUDHURY, SHAIL BALA JAIN

[2] https://www.electronics-tutorials.ws/waveforms/555_oscillator.html

[3] Shirude, Nilesh & Gofane, Manoj & Panse, M.S.. (2014). Design and Simulation of RADAR Transmitter and Receiver using Direct Sequence Spread Spectrum. IOSR Journal of Electronics and Communication Engineering. 9. 56-65. 10.9790/2834-09365665.

[4] https://www.mathworks.com/help/comm/ref/comm.pnsequence-system-object.html