

Designing of Frequency divider circuit using Opamp Multivibrator and Mod-8 Counter

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February 28, 2022

Abstract- Analog and digital applications require the use of frequency division to tailor the signal according to the circuit requirements. This repository represents the design and simulation of mixed signal circuit -'Frequency Divider' using Opamp Multivibrator (Analog Circuit) and MOD-8 Up Negative edge triggered Counter (Digital Circuit). The Op-amp Multivibrator is an astable oscillator circuit that generates a rectangular output waveform and counter divides the frequency of that waveform by 8. **Keywords-** frequency divider, counter, Multivibrator, Opamp, D flipflop

I. Circuit Details

1) Opamp Multivibrator:

The Op-amp Multivibrator is an astable oscillator circuit that generates a square wave using an RC timing network connected to the inverting input of the operational amplifier and a voltage divider network connected to the other non-inverting input. It has two states, neither of which are stable as it is constantly switching between these two states with the time spent in each state controlled by the charging or discharging of the capacitor through a resistor. The Time period of the square wave is given by:

$$T=2RC \ln(1+\text{Beta}/1-\text{Beta})$$

Where, $\text{Beta}=\text{R2}/\text{R1}+\text{R2}$

2) Divide-by-8/ Mod-8 Counter:

The three chain D-flipflops which acts as a negative-edge-triggered up-asynchronous counter (Ripple Counter).

The first D flip-flop is clocked by the external clock pulse and then each successive flip-flop is clocked by the complemented output of the

preceding flip-flop. First flipflop toggles at the negative edge of external clock pulse. Second and third flipflops toggles at every negative clock edge of preceding output of the flipflop. One flip-flop will divide the clock, f_{clk} by 2, second flip-flops will divide f_{clk} by 4 and thus after third flipflop, we will get frequency f_{clk} divide by 8.

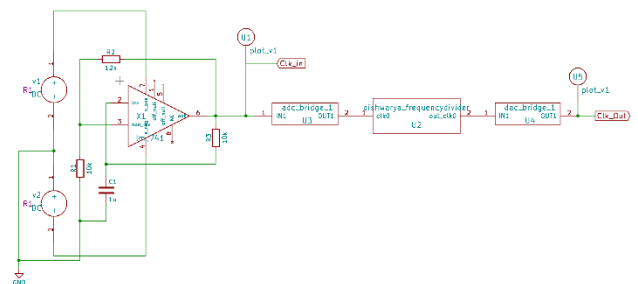
Observations:

Operating Voltage of the circuit is 5V

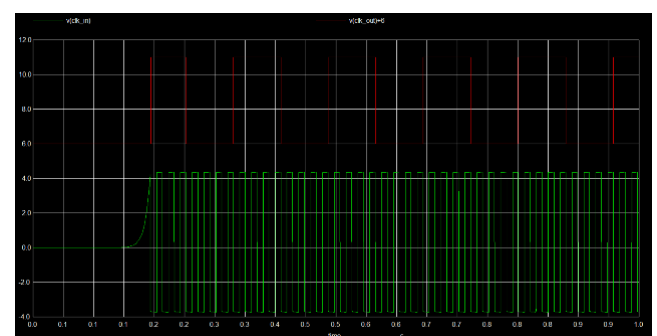
$$\text{Beta}=\text{R2}/\text{R1}+\text{R2}=10/22=0.4545$$

$$T=2RC \ln(1+\text{Beta}/1-\text{Beta})=0.0196 \text{ s} = 19.6\text{ms}$$

II. Implemented Circuit



III. Implemented Waveforms



References

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- [2] https://www.tutorialspoint.com/linear_integrated_circuits_applications/linear_integrated_circuits_applications_wav_eform_generators.htm