Implementation of MOD-10 Ripple Counter using mixed signal.

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Abstract

A Mod-10(decade) counter is a sequential circuit which counts from 0(0000) to 9(1001) after 9th pulse i.e.; on the 10th pulse it is resets to 0. Input to the decade counter is given through Op-amp Multivibrator which generates clock pulse to the counter.

1. Reference circuit Details

Op-amp 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:

$T = 2RC \ln(1 + \beta / 1 - \beta)$

Where, $\beta = R2/R1+R2$

MOD-10(decade) Ripple Counter:

MOD-10 counter also called as Decade counter has 10 states, it counts sequence from zero (0000) to decimal nine (1001). A decade counter is also often used for dividing a pulse frequency exactly by 10. The input pulses are applied to the paralleled clock inputs, and the output pulses are taken from the output of flip-flop, which has one-tenth the frequency of the input signal. In the proposed work, we are going to design digital blocks with the Verilog behavioural design of the JK flip-flop and NAND gate that is used as a basic block for the decade counter. To use these digital blocks we are going to interface digital to analog and analog to digital converters.

2. Reference Circuit

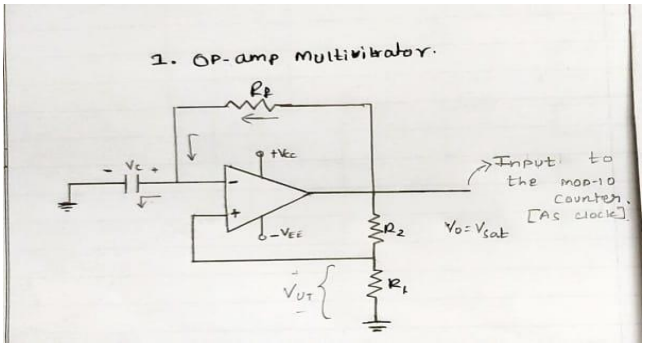

Fig 1: Op-amp Multivibrator

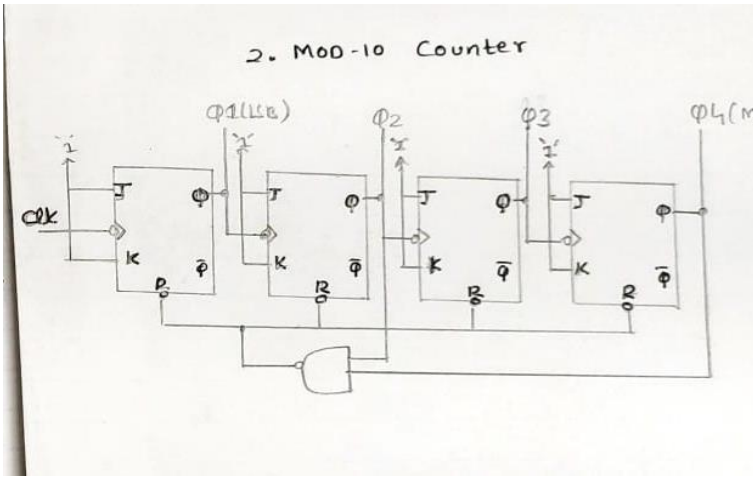

Fig 2: MOD-10 Counter

3. Reference Circuit Waveforms

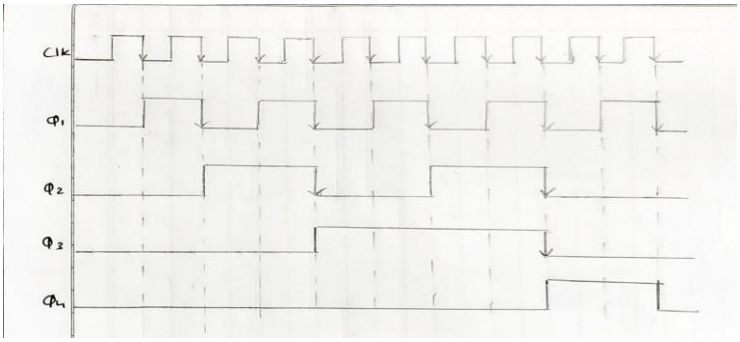

Fig 3: Output waveforms of MOD-10 Counter

References

[1] https://www.electronics-tutorials.ws/counter/mod-counters.html

[2] https://www.tutorialspoint.com/linear_integrated_circuits_applications/linear_integrated_circuits_applications_waveform_generators.html