RING OSCILLATOR

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Abstract

This paper represents the design and analysis of Ring oscillator. Ring oscillator consists of odd number of stages with feedback circuit which forms a closed loop in which each stage output depends on the previous stage. The voltage controlled ring oscillator (VCO) is a critical and necessary component in data communication systems and clock recovery circuits. It is basically an oscillator, whose output frequency is controlled by the input control voltage. Periodic steady state response of ring oscillator is also observed. Power consumption is to be reduced .The NOT gate is used as vehicle to introduce basics on signal propagation and also to present simple design models.

1 Circuit Details

Odd number of stages gives the inverted output when the input voltage is given at once to the first stage, the oscillation starts. When oscillation begins, Barkhausen Criteria must be satisfied to sustain stable oscillation. Ring Oscillators are composed of a number of inverters or delay stages connected to each other in the form of a chain, with the output of the last stage fed back to the input of the first The most important factor in ring oscillator is gate delay because in devices fabricated with MOSFET, gate cannot switch immediately. The gate capacitance needs to be charged before current flows between drain and source so that every inverter takes time to give output. Therefore increase in the number of stages of ring oscillator increase the gate delay. Odd number of inverter stages used to give the effect of single inverter amplifier with a negative feedback gain of greater than one so that the output will be in opposite direction to the input and it will be amplified with an amount more than the input. Amplified, inverted output is then propagated to the input with delay where it is amplified and inverted again. Digital and analog circuits have an important factor known as the propagation delay or gate delay. Propagation delay in ring oscillator is defined as the time difference between input and output. And the applications are Ring oscillators can also be used to measure the effects of voltage and temperature on a chip. The voltage-controlled oscillator in most phase-locked loops is built from a ring oscillator.

2 Implemented Circuit

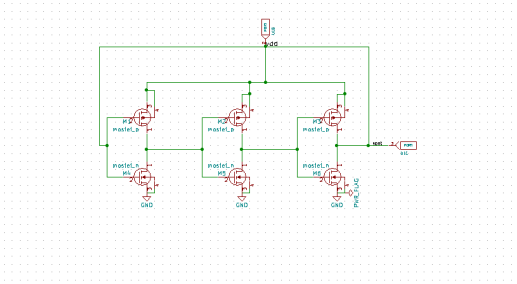

Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

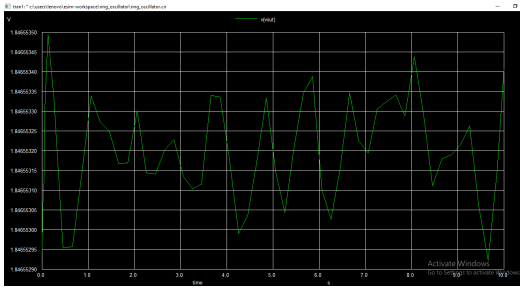

Figure 2: Implemented waveform.

References

[1] S. A. Vandna Sikarwar, Neha Yadav. Design and analysis of cmos ring oscillator using 45 nm technology. 3rd IEEE International Advance Computing Conference (IACC),2013.