Design of Multiple Waveform Generator & Frequency Counter Based On DDS

Mr. Pranjal A. Charde[1], Prof. P.R. Lakhe[2], Mr. Akshay P. Nanote[3]

[1] M. Tech. Research Scholar, Electronics (Communication Engg.)S.D.C.E. Selukate, Wardha, Maharashtra, India
[2] Assistant Professor Department of Electronics and Communication Engineering S.D.C.E. Selukate. Wardha, Maharashtra, India
[3] Assistant Manager Gupta Energy Pvt. Ltd., Deoli, Wardha, Maharashtra, India

---***---

Abstract - *Direct Digital Synthesizer (DDS) is important role in modern digital communication. DDS is new frequency synthesis technique which starts from the concept of phase and directly synthesis waveform required. It has beneficial for fast frequency switching, fine frequency resolution, large bandwidth, and good spectral purity. DDS consists of a phase accumulator, a phase to sine amplitude converter, digital to analog converter. The DDS consisting multiple waveform generators. DDS producing sine and cosine output simultaneously by using only one lookup table. It has able to work in high speed frequencies and it is a method for digitally creating arbitrary waveforms from a single, fixed frequency reference clock. It also consumes very less power than the conventional signal generator. DDS circuit occupies less area and power dissipation. It is to generate multifunctional waveforms at any desired frequency.*

1. INTRODUCTION

Direct Digital Synthesizer (DDS) plays an important role in modern digital communication. It is popular technique for frequency synthesis and DDS devices are very compact & draw little power. The ability to accurately produce and control waveforms of various frequencies. In industrial and biomedical applications use a DDS as a programmable waveform generator. It is a method of producing an analog waveform by generating a time varying signal in digital form and then performing a digital conversion to analog conversion.

This device can be generate various type outputs signal waveforms or multiple waveform generator. The aim of DDS can be achieved of the high-frequency.
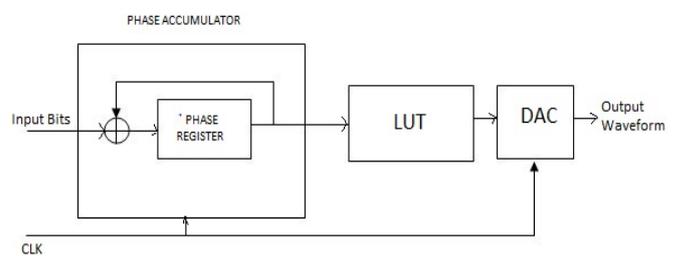
Fig. DDS Architecture

Phase Accumulator: - It consists of Phase register and adder. Input 32 bit is provided to phase accumulator for each clock cycle, the content of phase register increases by adding previous count and current count then corresponding voltage level value is provided to LUTs.

LUTs: - The voltage level received from phase accumulator is compared with the value stored in LUT according to that if the exact value is not present in that case the nearest value is taken & provided to DAC as a sample signal.

DAC: - The digital samples from LUT are converted to analog waveform by this converter.

An analog waveform usually generating a time varying signal in digital form and then performing a digital conversion to analog conversion.Digital frequency meter is a measuring instrument and it can be use in general simple measurement & in other fields, like teaching, scientific research and industrial control. The accurate and efficiency of frequency measurement often determine the performance and benefit of instrument, meter or industrial control system, but the precision of frequency measurement has a direct relation with the scientifically and rationality of frequency measurement methods. DDS device are primarily digital, it can offer fast frequency switching

between output frequencies, fine frequency resolution, and operation over a broad spectrum of frequencies. A number of high efficiency   generations of spectrally pure, wide-band, multi carrier waveforms is a key objective in modern communication and radar applications. A high-efficiency signal generator is a device that cans various type outputs of Signal waveforms, such as sine, cosine, saw tooth, square, triangle, trapezoidal wave and so on. This aims can be achieved by direct digital synthesizer (DDS) of high-frequency RF waveforms with high bandwidth and linearity. Such a DDS would exclude non-linear, narrow-band, high-cost analog microwave components, Implementing an essentially digital transmitter. It would allow one to combine digitally multiple waveforms. Then synthesize directly the composite RF signal. Maintaining the digital nature of the generated RF signal all the way to the power amplifier would be enabled by the use of new highly efficient high-speed semiconductor digital amplifiers. It also would enable the implementation of digital pre-distortion at the RF level compensating for non-linearity of the amplifier chain. Such Digital RF architecture. Today's DDS devices are very compact and draw little power.

DDFS we developed a new structure for the ROM[3] section that makes it to give us the sine and cosine wave digital output signals simultaneously by used of just one lookup table in an efficient way. A direct digital frequency synthesizer plays an important role in modern digital communications. It has advantages of fast frequency switching, fine frequency resolution, large bandwidth. DDFS is an essential technique to generating mention frequencies whenever extremely precise frequency resolution and fast switching speed are required. DDS consists of a phase accumulator, a phase to sine amplitude converter, a digital to analog converter and a filter. Its major parts are sine or cosine wave generator and phase to sine amplitude converter. Producing the sine and cosine output simultaneously has used basically in quadrature structure.

2.   PROPOSED METHODOLOGY

Proposed work consists of multiple waveform generator has to be simulate with the help of modelsim simulator for showing the result in the analog form &

also it generate using Xilinx ISE in the form of digitally.
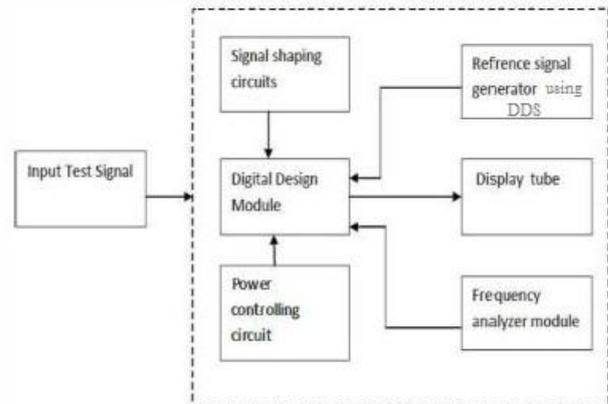
Fig. Block Diagram of Waveform generator & frequency   counter using DDS

Input Test Signal: It is use for providing the input signal with the help of test bench.

Signal Shaping Circuit: The frequency of input signal irrespective of amplitude variation, the input signal is shaped which result in only two levels of amplitude.

Reference Signal Generator by DDS: As describe previously DDS will generate multiple waveforms which are use for reference signal.

Digital Design Module: The input signal is compared with reference signal to obtain the frequency measurement.

Power Controlling Circuit: It is use for the combination of input signal and reference signal generator.

Frequency Analyzer Module: By using frequency analyze module we can observed different frequency for different waveforms.

Fig. 2 Sine & Cosine Wave Generation:

3. OUTPUT

In this module we are generating only sine and cosine waveform in digital form & also simulate in analog form with the help of Modelsim simulator.

Fig. 3 Output Waveform

Fig. DDS RTL View & Waveform generation.

Fig. Output of Waveform Generation

Fig. RTL view of counter

Fig. Output waveform of Counter

Fig. Analog waveform of Sine & Cosine
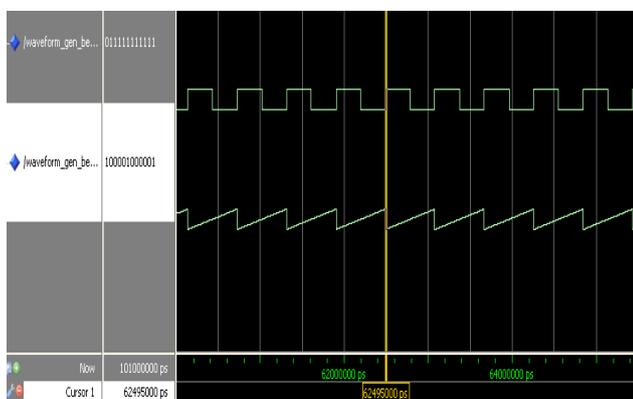
Fig. Analog waveform of Square & Sawtooth

SIMULATION PARAMETER

SR. NO.	PARAMETERS	RESULT
1	No. of slices	23
2	No. of slices flip flop	44
3	No. of 4 input LUTs	34
4	Delay	2.395ns
5	Power	0.02720W

4. CONCLUSIONS

The power consumption and area is main because, we get improved the result along with delay. In this project

we have generate the Sine, Cosine, Square & Sawtooth waveforms by using Direct Digital Synthesizer(DDS) This design is useful for measuring signal values at high frequency upto100MHz and the power consumption is reduce upto 0.02720W.

REFERENCES

[1] Thottempudi pardhu, Sunkara Harshitha" Design and   Simulation of Digital Frequency Meter using VHDL" 2014 IEEE

[2] *Deepthi P, Manju Mohan, S Raghavan" PSoC Embedded Design for Ultra Low Digital Frequency Meter"* 2015 IEEE

 [3] Mohsen Padash, Siroos Toofan, Mostafa Yargholi "A 9-Bit, 1-Giga Samples per Second Sine and Cosine Direct Digital Frequency Synthesizer" 2014 IEEE

[4]Hesham Omran, Khaled Sharaf, and Magdy Ibrahim "An All-Digital Direct Digital Synthesizer Fully Implemented on FPGA" 2009 IEEE

[5] Qinghong L1, Dong Yang, XiaoHua Mu, QingLin Huo "Design of the L-band wideband LFM signal generator based on DDS and frequency multipliction" 2012 IEEE

[6] A. Giuseppe Maria Strollo and D. De Caro, " A 630 MHz, 76 mW direct digital frequency synthesizer using enhanced ROM compression technique" IEEE Journal of Solid-State Circuits, Vol. 42, NO. 2, Feb 2007.

[7] Xiaodong et al. "A compact direct digital frequency synthesizer for system-on-chip," Solid-State and Integrated-Circuit Technology, 2008. ICSICT 2008.

[8] H. Yeoh , J.-H. Jung , Y.-H. Jung and K.-H. Baek "A 1.3-GHz 350-mW hybrid direct digital frequency synthesizer in 90 nm CMOS", IEEE J. Solid-State Circuits, vol. 45, no. 9, pp.1845 -1855 2010.

[9] X. Yu , F. F. Dai , J. D. Irwin and R. C. Jaeger "A 12 GHz 1.9 W direct digital synthesizer MMIC implemented in 0.18 um SiGe BiCMOS technology", IEEE J. Solid-State Circuits, vol. 43, no.6, pp.1384 -1393 2008.

[10] X. Geng , F. F. Dai , J. D. Irwin and R. C. Jaeger "An 11-bit 8.6 GHz direct digital synthesizer MMIC with 10-bit segmented sine-weighted DAC", IEEE J. Solid-State Circuits, vol. 45, no. 2, pp.300 -313 2010.