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A Review on linearize VCO-ADC

Engineering

Chandrashekhar SSGI (FET) Bhilai, India
Anil Kumar Sahu SSGI (FET) Bhilai, India

ABSTRACT

This paper given the review of voltage controlled oscillator (VCO) based analog to digital convertor (ADC) for Frequency synthesizers, current sensing, wireless communication. The main parameter such as linearity carrier frequency, supply voltage, tuning range, power dissipation, figure of merit (FOM) propagation delay were reviewed exhaustively .

KEYWORDS:

Voltage Control Oscillator (VCO), Asynchronous Sigma Delta Modulator, Operational Amplifier, Linearity, ADC.

INTRODUCTION

VCO has become very demanding due to having its unique and simplified signal processing features. The VCO is an electronic circuit which gives an oscillatory output voltage. A VCO is an oscillator whose output frequency changes in directly according to the applied input voltage. VCOs can oscillate from few Hertz to hundreds of GHz. Several techniques to alleviate distortion caused by the VCO's nonlinear tuning curve have been proposed in recent years. VCO based ADC's usually using digital circuits which results in the technology scaling. VCO ADC has becoming more advance research of implementing in many of the applications such as radio, wireless receiver, audio, communication, signal processing, current sensing.

One of the simplest VCO ADC are open loop configuration frequency domain first order sigma delta converter can be realized without feedback. Another type is close loop VCO ADC in this output are feedback to input. Block diagram of closed loop VCO ADC shown in fig 1

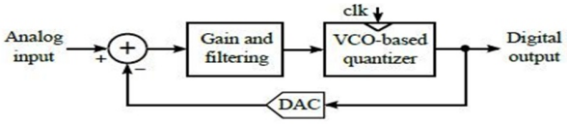

Figure1: block diagram of close loop VCO ADC

Voltage control oscillator (VCO) based analog to digital convertor (ADC) is a time based architecture to shaping noise and implemented using a VCO and digital circuit[1-6].Overall linearity should be limited should by using ring oscillator VCO non linearity problem has been solved. Distortion present in the circuit are analyzed and effect of distortion has been reduced [8-9].

SUMMARY

A number of research papers of various journals and conferences were studied and survey of existing literatures in the proposed area is reported.

[2] This paper analyzes the nonideality and noise shaping of VCO-based ADCs. By adding digital calibration techniques are added in VCO to improve sampling frequency noise shaping property and dynamic rang has been improved but VCO output non linearity has been introduced in the circuit. Block diagram of digital calibration for VCO shown in figure 2 below

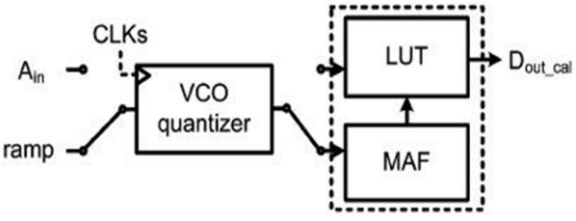

Figure 2.block diagram of digital calibration for VCO

[1] Non linearity introduced in the VCO-ADC in previous paper this paper deal how to minimize the nonlinearity. This paper ring oscillator voltage control oscillator used in VCO-ADC to linearize output. Ring oscillator VCO consist of main inverter and auxiliary invertor. Auxiliary invertor are introduced to align edge of main invertor. To improve more linearity in input resister R1 and R2 has been introduced RO VCO. Value of R1 and R2 are adjusted so non linearity has been cancel out for delay element and good linearity has been achieved.

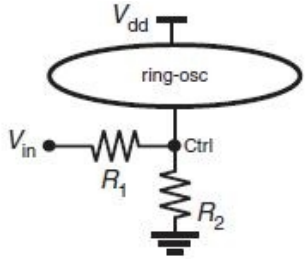

Figure 3. RO with resistive input

[3] Today technology scaling chip size are reduced so integrator based VCO ADC become more complex and required more power so this less suitable according to need. One alternative approach VCO with reset counter. Reset counter eliminates the use of integrator and using this quantization error are also reduced.

[7] This paper in place of ADC use PWM modulator. Which convert input continuous signal into two level digital signal using sampling and quantization information is stored in binary form. This techniques amplifier are eliminated so complexity power requirement and chip area are also reduced. In this techniques resolution linearity and over sampling ratio also improved.

[10] At present day PWM are not suitable due to its input-output nonlinearity so many application this techniques are not used. One of important and popular approach to solve this problem known as Asynchronous sigma delta modulator. Asynchronous sigma delta modulator consist of closed loop with Schmitt trigger and filter. To improve performance one loop delay block are introduced between filter and Schmitt trigger. Block diagram of ASDM are shown figure 4.

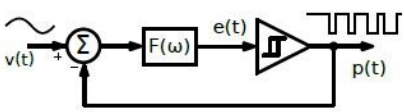

Figure 4. General representation of ASDM

Asynchronous sigma delta techniques improve linearity and performance of VCO-ADC. This techniques suitable according to technology scaling recent need.

VCO ADC OVERVIEW

TABLE – 1

REVIEW OF RELATED RESERCH WORK

Ref no	Methodology Used	Results	Remarks
[1]	Ring oscillator VCO	Pd-0.5mW,SNDR-65dB	Good linearity
[2]	VCO based ADC with digital calibration	Fs-500 MHz,SNR-21.3dB,high BW,,Pd-12.6mW	VCO-ADC has been analyzed
[3]	VCO with counter	Fully digital,	Beneficial for technology scaling
[7]	VCO with PWM pre coding	Good Resolution, low power dissipation	Amplifier are eliminated
[10]	ASDM with VCO	Distortion is determined and eliminated,	Using Schmitt trigger threshold voltage has reduced

CONCLUSIONS

This paper provides an overview and analysis of (in Table I) different VCO ADCs. By analyzing and using new concept to improve performance of VCO ADC linear, distortion free, low supply voltage, smaller chip area, high resolution less noisy has been achieved according to todays need.

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