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FIR filter design for 2-1 Sigma-Delta Modulator using Simulink Model.

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ABSTRACT

There are different types of filter design methods are presented. The previous methods like Robust filter design, optimal low frequency filter design are very complex techniques for determining noise transfer function and reduction of first stage noise. In this paper, a new method is used for reduction of first stage and second stage noise. Curve fitting mechanisms are used for filter design of sigma-delta modulator. These methods are easy compare to others techniques. Construct a Simulink model diagram for cascaded sigma delta modulator filter design. Through Simulink, construct a sigma-delta modulator and filter designs and estimate the waveforms. For getting high accuracy, generally sigma-delta modulators are used.

Keywords: Sigma-Delta Modulator, FIR filter, Curve Fitting, MATLAB tools

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INTRODUCTION

The sigma-delta modulators are used in wireless and telecom system. In some applications, Sigma-delta modulators are generally not get more accuracy. The accuracy of the SDM will be reduced even through high order techniques are used. Design methods are guarantee gives performance over the uncertainties in the analog components. Several methods are there to minimize the uncertain the SDM. Analog components are provided alternate method for matching problem. Robust matching filters design based on weighted convex optimization. The finding method for filter design is very complexity in mathematical design methods are complex in mathematics. So, prosed new method based on curve fitting.

Simple calibration technique [1] use for adaptive digital correction of multiple quantization delta–sigma modulators. Gain is mismatch in the signal path due to a non-ideal signal transfer function in the modulators. Disadvantage of this technique is interrupting normal operation at input. On-line is containing two converters and another for remains active. The implementation on analog circuitry is minimum cost but complexity. Adaptive digital technique [2] used and minimizing the leakage noise in the output signal. Test signal was replaced by calibration methods for detecting filter design. Test signal used to control the digital noise_ cancellation filter. Digital structure mainly utilized the correlation of output signal with test signal. Three design examples are descried by the correction techniques. Corrected systems are implemented on chip. It achieves ideal SNDR performance. Remaining two are improved version of first design. These methods provide very fast and accurate ADC performance. [3] represents a SDM architecture with different manner. These different techniques are need for different models. Introduce a new model for filter design. Noise is generated from the filter. Noise is reduced from these filters using different techniques. The SDM implementation is done by cadence and operating voltage is 2.5v.The filter design [4] is mainly constructed by new method. From this method, get no matching problems. Analog problems are also minimized. First and second order poles and zeros are estimated easily but other than orders are not possible. From this method, can solve higher order unsolved problems. For noise cancellation, so many filters are used. The required filter design only solves that filtering problems. From digital circuits get less noise. Filter implementation is easy but can construct poles and zeros for this method. The book [5] mainly explains about order types of delta sigma modulator. First order, second order and higher order sigma-delta modulators are considered. In first order delta-sigma modulator, Mod1 is used as ADC or DAC.Mod1 requires large OSR for accurate data conversion.MOD2 sued in second order delta-sigma modulator. Mod1 is not suitable for all applications. so we overcome for that purpose we use mod2.but mod2 increases hardware complexity and decreases in allowable signal range. Loop architectures are descried in higher order sigma-delta modulators. Many design techniques are used for filter design. The techniques are based on different methods. The filter is constructed by a LMI method [6]. This method is suitable for finding the matching problems in parameters in the circuits. The advantage of the LMI method is retting work is simple, but working at less conditions only. The method is used to solve the design filter problems. The advantage of $H\infty$ filtering method is cost factor and give good performance. This process not increasing complexity of circuit. But designing filter and mathematical solutions are complex. Robust matching filters design based on convex optimization [7]. state-space representations give complicated models and high-order designs. Filters satisfying the $H\infty$ bound problems. SDM converters are provide good resolution by providing feedback and over lapping. Cascade architectures are requiring accurate analog components with digital filter for preventing quantization noise. Central polynomial LMI method is proposed for delta sigma modulator. Central polynomial has two advantage than the state space LMI method. one is filter order can be fixed from outset and another one is it deals with multilinear models. Robust matching filters design based on weighted convex optimization[8]. The finding method for filter design is very complexity in mathematical design. The finding solution in mathematical form is complex. Formal optimization of low frequency method is used for design a filter. Low frequency models of sigma-delta modulators have derived accurate to second order in frequency. Optimal matching filter is formally derived for the model to reduce the noise in first stage at all frequencies. Curve fitting tools are available in MATLAB [R2013a] software. These tools are generally converting data points to different fitting mechanisms. Construct a Simulink model diagram for sigma delta modulator filter design. Through Simulink, construct a sigma-delta modulator and filter designs and estimate the waveforms. For getting high accuracy, generally sigma-delta modulators are used. First order and second order SDM are not getting high accuracy for some applications. So, in this paper, construct a Cascaded SDM for some applications for getting high accuracy and as well as related parameters.

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MATLAB SIMULINK MODELS

Simulink, developed by Math Works, is a graphical programming environment for modelling, simulating and analysing multidomain dynamic systems. Its primary interface is a graphical block diagramming tool and a customizable set of block libraries. Two types of MATLAB Simulink models are performed in this paper.

Sigma-delta modulator Simulink model

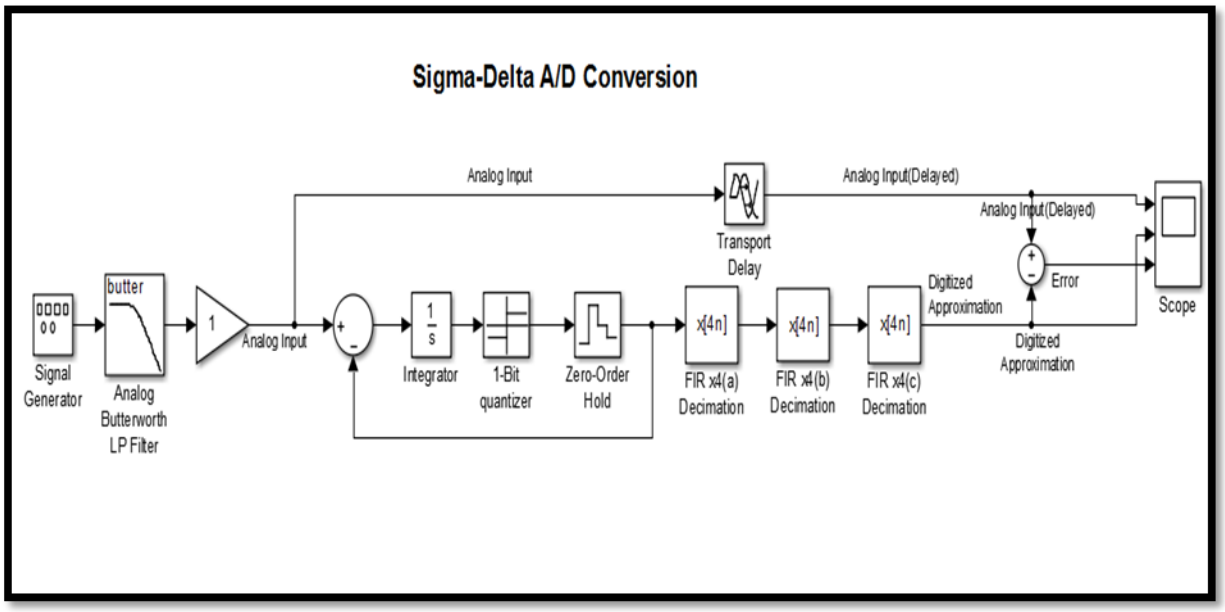

Figure 1: Over sampled sigma-delta modulator Simulink model

The over sampled sigma-delta modulator is a noise shaping quantizer. The main purpose is reshaping the spectrum of quantization noise. The main objective is not only increasing the sampling rate, but also reducing the number of bits per sample. Each decimator stage reduces the sampling rate by a factor of four. For setting time delay in transport delay, latency is introduced by filters. Three FIR decimation filters each introduce 16 samples of latency. Total delay is 336 samples in decimation operations.

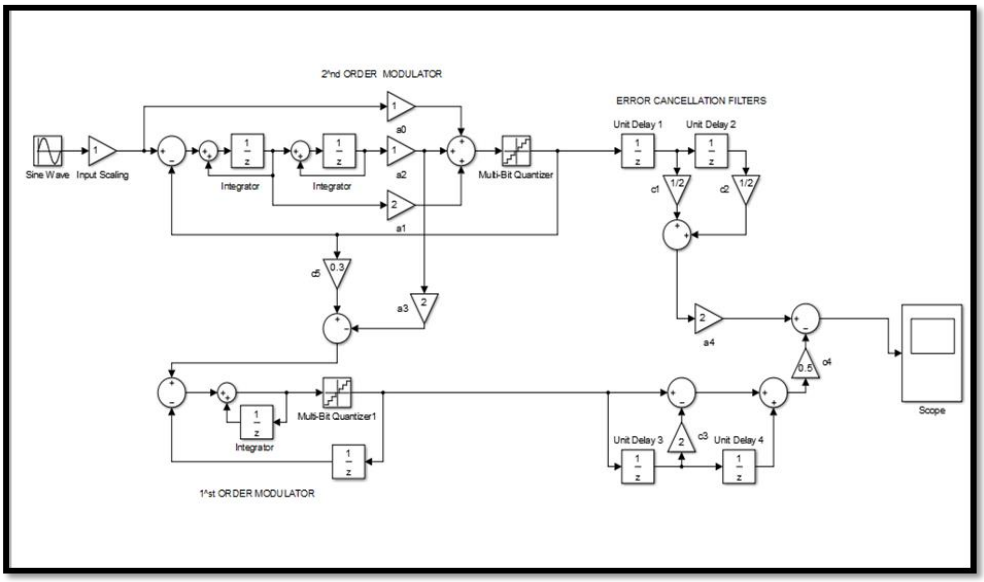

Figure 2: cascaded [2-1] sigma-delta modulator Simulink model

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Cascaded sigma-delta modulator Simulink model

2-1 sigma-delta modulator is a cascaded sigma delta modulator. 2-1 sigma-delta modulator mainly consists of two stages. First stage consists of second order sigma delta modulator and second stage consists of first order sigma-delta modulator. Both stages are cascaded and form the 2-1 sigma-delta modulator. Matching filter are used for reduction of noise. When both stages are cascaded, the first stage quantization noise in processed by the second stage. A matching filter is placed at the second stage output for cancel the first stage quantization noise at the final subtraction for output.

EXPERIMENTAL RESULTS

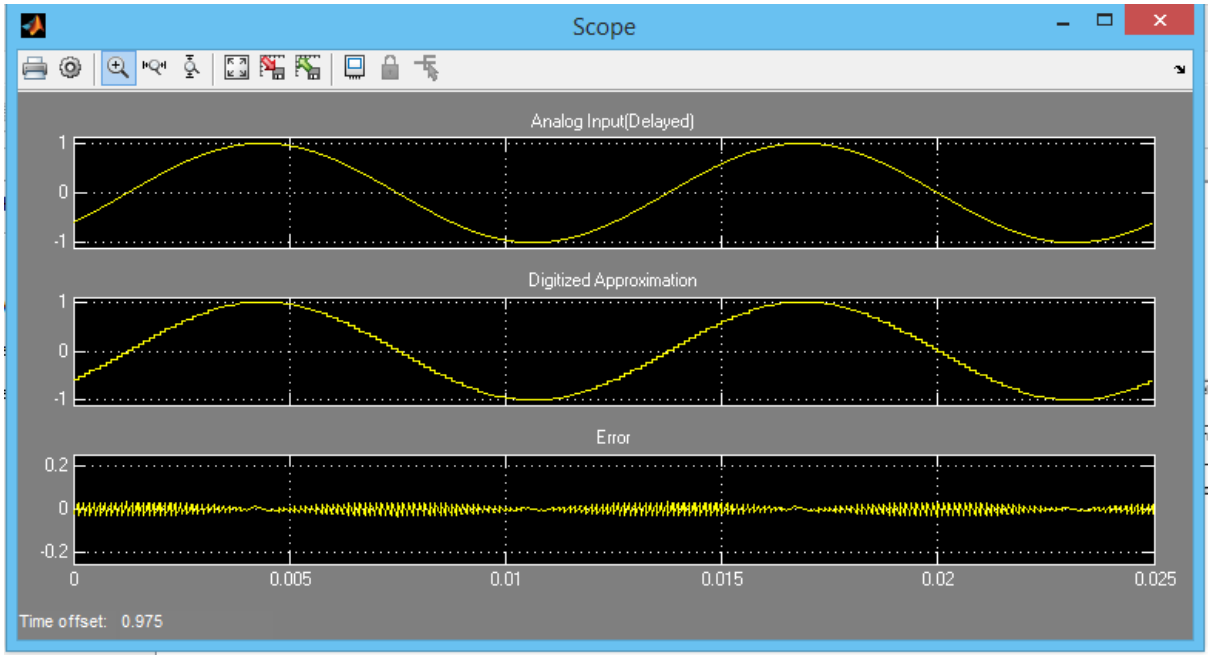

Figure 3: Sigma-delta modulator output wave form

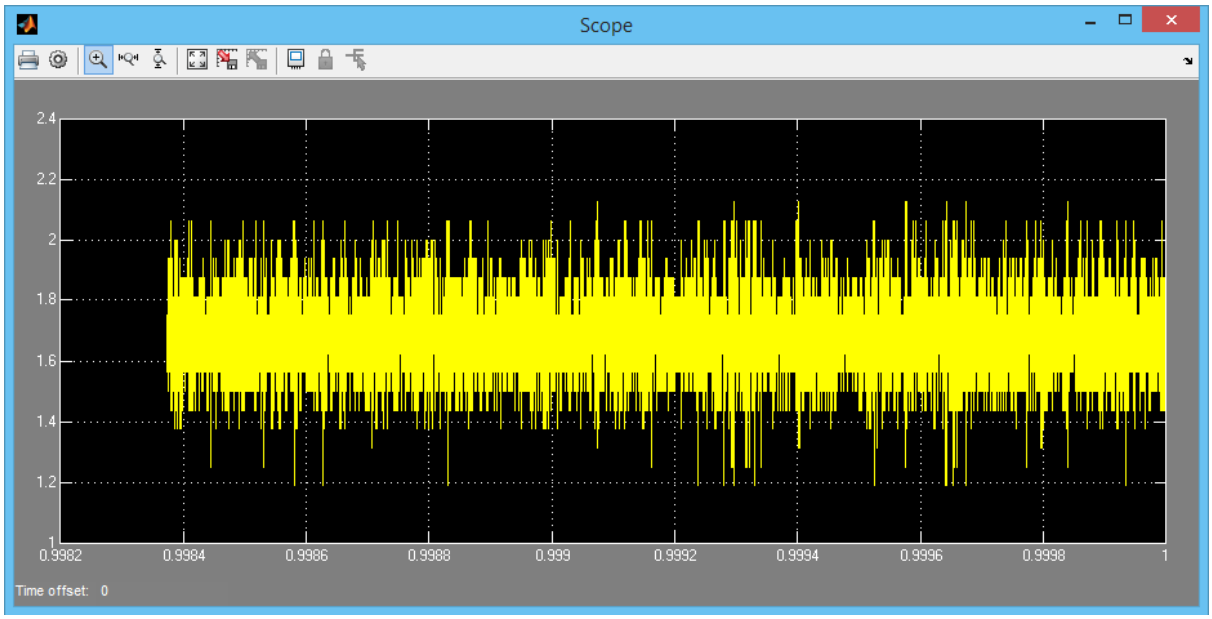

Figure 4: cascaded sigma-delta modulator output wave form

Figure 3 and Figure 4 are explained about the output response of the sigma-delta modulator and cascaded sigma-delta modulator. In figure 3 output waveforms, normally analog signal is input, it follows through transport delay, so analog delayed signal was formed. Through decimation filter, digitized wave was generated for analog signal. In sum2 port error signal was calculated as difference between analog and digitized signals. In figure 4, at the sum port finally got digitized output waveform.

CONCLUSION

In Robust filter design and optimal low frequency filter design complex optimization techniques are used for reduction of first stage noise. Curve fitting methods are simple when compare to other design methods. In optimal FIR filter design, get minimization of first stage quantization noise. MATLAB Simulink model is used for getting output wave form for the sigma-delta modulator. Cascaded sigma-delta modulators are used specially for getting high accuracy. The first stage noise is eliminated when using the Cascaded [2-1] sigma-delta modulators. For reduction of second stage noise, one more cascaded sigma delta modulator added to the circuit. Sigma-delta modulator and cascaded sigma-delta modulator output waveforms are plotted by Simulink model.

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