ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

Review on Fir Filter Designing Using Wavelet Transform

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ABSTRACT: Wavelets, filter bank which has been used independty in the feild of Mathsmatics, Signal processing, Biomedical, filter designing respectively have recently cocentre to form a single theory. Wavelet is the funchion that satisfy certain requirnment. The diminuitive cannotation of Wavelet suggests the function has to well localized.There are many types of wavelets.One can choose wavelets, Compactly supported wavelets, wavelet with simple mathematical expression, wavelet with simple associated filters. In this work, we have studied the research done for designing the FIR filter design with the cooperation of Wavelet transform. The focus is on designing distinct techniques for designing FIR filter. Various properties and application are also introduced in this research work.

KEYWORDS: Wavelet Transform; FIR Filter; State space model; Perfect reconstruction.

I. INTRODUCTION

The Wavelet analysis is performed using a Single prototype funchion called a Wavelet which can be throught of as a bandpass filter, With the introduction of uncertainties, noise, errors in the channel we need a filter which shows symmetry for Perfect Reconstruction and stable. The objective is not to achieve ideal charactertics as it is impossible anyway but to achieve Sufficiently good Charactertics of the filter. FIR Filter is more advantageous over IIR Filter when used in time discrete state space model. Also, several works have been carried out to design perfect resolution. The new design of matrices introduced in this is Paraunitary, Unitary, Rational,loseless, Unimodular and linear.

II. LITERATURE REVIEW

Anupriyag et al. have introduced a new technique for Perfect Reconstruction, rather than using integer decimated factor it used Single-matched filter bank(FB) with Rational decimator factor. In this work, authors have also described detail study of the filter bank. Wavelet transform plays an important role in multiresolution analysis on the signal it gives time-frequency information. A Filterbank is introduced when decomposed a multilevel wavelet. In this work authors have proposed a different technique for overcomplete RFB, the various techniques are used to reduce aliasing and also add redundancy for filters bank. The authors have also designed analysis and synthesis filter, however, authors have proposed an FB with denser frequency tiling which has more advantage over other because it is simpler, represent a fragmented form of the input signal. Also in this work authors have right to change the different decimation ratios. This technique also improved compressibility.[1]

Muhamad chehaitly et al. introduced a new architecture for Discrete wavelet packet transform (DWPT) through Malat Tree Algorithm. It is the algorithm that provides high throughput because of reducing hardware and also in this algorithm different values of throughput is applied at the different level of architecture. Here in this algorithm author have used two Simulioon tools for designing an architecture. The tools are VHDL at RTL level and ALTERA QUARTUS 2 for synthesis. Authors have designed an architecture which is a tree-like structure which applied at synthesis, help to determine the order of filter and also help to quantize the filter coefficient which is necessary for the filter design. This architecture also provides maximum which depends on filter order and provides flexibility for automatically loaded filter coefficient after synthesis.[2]

Ramirez-Echeverria et al. proposed that for Minimal Square Error(MSE) in discrete time state space FIR filter. Authors have Estimated the optimal memory. There exist no relation between the optimal memory and filter order. In this estimation, we donot include any type of distortion and noise which is the significant property. Also optimal memory

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N_{OPT} can be determined with the help of mean square value(MSV). Authors have also applied learning cycle for determing N_{OPT}.[3]

Jian–Ao lian and Yonghui wang proposed that with the help of Biorthoganal funchion and wavelets who follows the condition of Energy Conservation(EC) are used to construct PR FIR Filter. FIR Filter is designed with the help of filer bank which also preserves the energy. In the field of image processing, filter designing needs odd length filter banks. They defined the Symetry property of biorthogonal wavelets and it shows linear phase (FIR) Lowpass and Highpass PR Quadrature mirror filter (QMF) are supported together. Odd length FB are used to remove artifacts that exist in image boundary. In this work, authors have introduced four Energy conservation(EC) condition, however, EC(3) normally increse the QMF. For achieving desirable properties and improvement of performance of PR FIR QMF authors have incresed the length of the filter.[4]

Ya gu et al. has proposed an algorithm to replaced the undesirable noise term and unknown variable and also estimate the parameter and states for one step state-delay systems. This algorithm is used for single input single output(SISO) Linear system. They have also introduced a combined state and least square parameter for a dynamic system. Here in this paper author has used estimate state insteadof unknown variable.[5]

Choon ki ahn has proposed that FIR filter chooses for non-linear signal model compared to IIR filter because IIR Filter containss undesirable signal due to past memory but FIR filter shows stability, removed the unknown and random error,uncertainities and provide perfect signal reconstruction. In this paper, the author has introduced a new filter which is known as Stickly Passive FIR Filter (SPFF) for a linear state space signal model with external disturbance. To reduce an external disturbance the author has introduced a passivity property of the SPFF. The SPFF can be designed using Linear Matrix Inequality (LMI) feasibility problem. It is a linear filter with finite output contain quasi dead beat property.[6]

Selvaraaju Murugesan & David B.H Tay have proposed a technique to preserve vanishing moment of the biorthogonal and orthogonal filter and also Rationalize the orthogonal and biorthogonal filter with perfect reconstruction. However, in the orthogonal filter it shows energy preservation but donot show symmetry due to this reason biorthogonal filter are preferred. For the regularity of the wavelet, Vanishing moment (VM) plays a significant role. Biorthogonal filter banks preserve many VMs at each stage but orthogonal filter bank preserve atmost one VMs. Here authors have proposed another technique Zero dc leakage preservation which rationalizes the orthogonal filter. Complementry filters are used for the biorthogonal filter.[7]

Pyung so kim has proposed a FIR filter which is used for State estimation with the help of Kalmann filter with recursive IIR Structure. Through recent research work, optimal FIR filter shows better properties for discrete time state space model compared to kalmann filter. It shows unbiasness and dead beat property which cannot be satisfied from kalmnn filter. However, the FIR optimal filter has compared to kalmann filter is Window initial condition has to be handled. This window initial condition is undesirable and unsuitable for FIR Filter, so several approaches has been proposed by the author to the handled window initial condition. State propagator and the Lyapunov Equation has been adopted by the author to a removed window initial condition in FIR Filter. This approaches somewhat sometime increases the uncertainity in the system initial state and system noises. In this work, the author has proposed a FIR filter for state estimation that can be derived from kalmann filter for the Discrete time state space signal model.[8]

Yury S.Shmaliy et al. have proposed a new smoothing FIR filter for discrete time polynomial state space model. The author has introduced two solutions for smoothing the FIR filter these are an Optimal solution and Unbiased solution. For the optimal solution author requires the initial state and measurenment noise and determined in matrix form but for an unbiased solution, it doesnot need any information about initial state and measurnment noise but it is determined in both form that is matrix and polynomial. FIR smoother were mainly used to design a non-linear filter, FIR median hybrid filter. In this paper Author also determined an example of Two state clock model in this paper that determines the filter efficiency. The application of the FIR smoothing mainly are filtering of images which the help of hybrid median FIR.[9]

G Sherlock and D.M.Monro have proposed a technique for finding filter coefficient of Perfect reconstruction (PR) FIR filter of different length. For the PR of FIR filter bank with the help of orthogonal wavelet. The authors have described variously parameter for determining filter coefficient as the author used Daubechies filter coefficient also they take different types of roots because parametrization is not unique, authors also describe the wavelets on the basis of a number of vanishing moment. In this work, authors have also described the symmetry properties of the space.[10]

P.P Vaidyanathan describes the parameter of perfect reconstruction(PR)FIR filter bank and this can be done with the help of orthogonal wavelet. For the PR of the FIR Quadrupture mirror filter(QMF) bank, the determinant of polyphase

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matrix (E(z)) of analysis must equal to delay. The author explores a different technique to describe such matrices. To solve problem author describe this in two problems that are first it describe the parameter of the loseless matrix and after that, it describes the parameter of the unimodular matrix. In this paper, the author uses different types of matrices for describing the parameter of the filter bank and also describe the problem in the parameter of the unimodular matrix that is converted into the problem in linear algebra.[11]

P.P Vaidyanathan describes the matrices which are a Unitary matrix and Paraunitary matrix. These matrices are great Application in Signal processing, Robustness digital filtering, and multirate filter bank design. These matrices are employed in the finite field when the author need to compute in finite feild. In this paper, the author has described various properties of these matrices. The author also determined and well applied these matrices in group feild (GF2).The Paraunitary matrix contains a degree one.[12]

III. CONCLUSION

We have carefully examined all the techniques that help to design the filter and the filter we design should satisfy the properties that we discuss in this work. New simulation tools and matrices have been introduced that help to design a filter in discrete time space state model. In this work, this technique can be extended to other scalar or multivariable linear or Non-linear systems. Work is presently in progress to seek forward for further improvement taking benifits of new techniques and algorithm. The revolution in this field is need generated. The industry and researchers in this field have joined hands to meet out this global demand.

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