

Band Pass Semi-Adaptive Digital Filters for Radar Applications

Pramil, Prateek, Parashuram

Abstract: *This paper demonstrates the Digital semi Adaptive Filter which is applied to Radar signals to reduce the blast. Semi Adaptive filter has the strong anti-noise ability; it can also achieve accurate Radar Signal in a very noisy situation. The clutter removing application of the semi Adaptive Filter has been used in spectrum cleaning of the atmospheric radar signals. The object of this work is to plan and recital assessment of band pass Bartlett and chebyshev semi adaptive filters. This design used MATLAB and XILINX software's. FPGA hardware SPARTAN kit use for translates realistic research design. The simulation results indicate that Adaptive Filter has strong anti-noise ability for Radar. These works keeping the sampling frequency at 5 MHz were compared and analyzed, optimized evaluated for 64 orders.*

Index Terms – Digital filter, Field Programmable Gate Arrays (FPGA) MATLAB software and XILINX software, SPARTAN-3E, DSP Chips.

I. INTRODUCTION

Degradation can be reducing by using filtering method FIR, Adaptive filter. The target of a future Radar Signal enhancement algorithm should be a decrease of discarded surroundings noise. Each method has its own advantage and efficiency depend on the type of noise. In Radar, discarded noise use energy and deteriorates the target information of the signal there are a variety of method to reduce noise both analog and digital. Each method has its own advantages and efficiency is often dependent upon the type of noise. The noise suppression has application is virtually all field of communication (channel equalization, signal processing etc.) and other field In this paper our experiments on filtering technology. The output signal from the filter is compare with the desired signal which we want to obtained and find the best filter for noise diminution. After conclusion the adaptive filter is best than the FIR filter and adaptive filter to achieve the best performance of Radar Signal. This research mainly focuses on design efficient digital adaptive filters to abolish the noise source associated with the radar front end signal so as to get a noise free signal as output from the filter.

II. PROPOSED METHODOLOGY

A. Software Design

The proposed software design block diagram is exposed in Diagram.1. The following design procedure uses :

- (i) Filter Design and coefficients fabrication matlab and Xilinx software tool is used.
- (ii) Design band pass 380-400 KHz semi adaptive Bartlett and Chebyshev Finite Interval Response digital filter xilinx software tool was used.
- (iii) 5MHz sampling frequency use for derived Filter response of order 63.
- (iv) MATLAB software use for manipulative of SNR

MATLAB tool use to generate particular digital filter response and coefficients for VHDL implemented design. Digital filter drawing can be conceded out often selecting diverse choice available in apparatus for creation of essential coefficients for the particular filter from the C header option of the matlab tool. VHDL file use C header files for designing.

B. Hardware Design

SPARTA-3E for translate software design for the realistic effort. Digital storage oscilloscope displays the input and output. The following realistic design steps were carried out. The DIP switches, SPARTAN Logic kit using for circuit design.

- (i) Design band pass semi adaptive filter for 380-400 KHz Bartlett and Chebyshev type Finite Interval Response in FPGA kit.
- (ii) DIP switches use for selecting different grouping such as sampling rates, frequency of the filter and input signal.
- (iii) Translation and restoration of samples using 16 bit A/D and D/A converters.
- (iv) AWGN noise mixed signal was passed through semi adaptive band pass filters for the frequency 380-400 KHz. Four DIP switches use for filter coefficients. 2 DIP switches for I/O and two selecting sampling rate.

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Dr. Pramil, EC Department, RNTU, Bhopal,
pramil327@gmail.com

Dr. Prateek, EC Department, RNTU, Bhopal,
pramil327@gmail.com

Dr. Parashuram, EC Department, RNTU, Bhopal,
pramil327@gmail.com

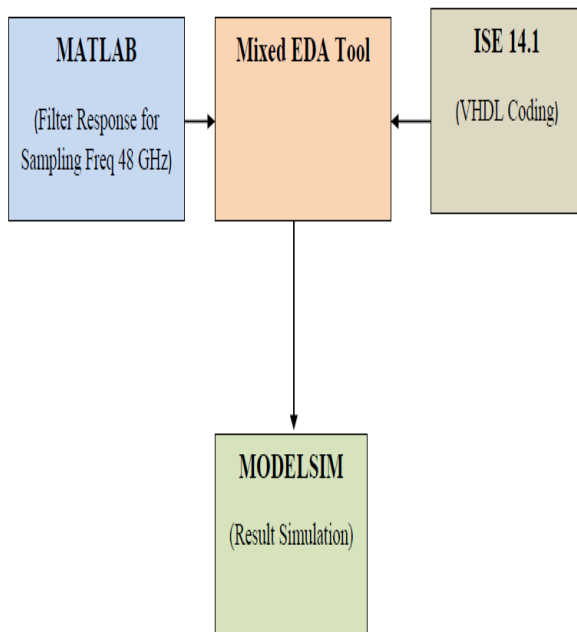


Figure 1. Block diagram of software Design

III. RESULTS AND DISCUSSION

Bartlett and Chebyshev digital band pass fir filters frequency responses are as shown in figures 2 and 3 respectively. Digital Bartlett and Chebyshev band pass FIR filters pass test signal of 390 KHz display in Figures 2 and 3 respectively. Bartlett and Chebyshev types of filters SNR enhancement display in figures 4 and 5. The input signal, test signal with noise and filtered output signals shown figure 6 obtained from realistic set up using FPGA kit pragmatic in a two channel digital oscilloscope.

Chebyshev filter observations specify that clatter is not concealed 100 percent and some clatter components seen in output and far lesser to Bartlett digital filter of the similar design.

In Bartlett types design evidently seen that clatter is concealed and the test signal has been passed. Bartlett type's software and hardware design response display in figures 4 and 6 correspondingly. Practically & the simulated filter Bartlett filter have rejected the noise. Two channel digital oscilloscopes observed Bartlett i/p signal and o/p signal which is using FPGA kit.

When compare Bartlett with Chebyshev of design. Chebyshev circuit original signal is totally mixed with noise indicating lowliness.

Bartlett digital filter SNR improvement factors is 7.76 dB and Chebyshev digital filter SNR enhancement factors is 7.56 dB which is shown in figures 4 and 5. SNR enhancement superiority of Bartlett digital filter is apparent from the similar design.

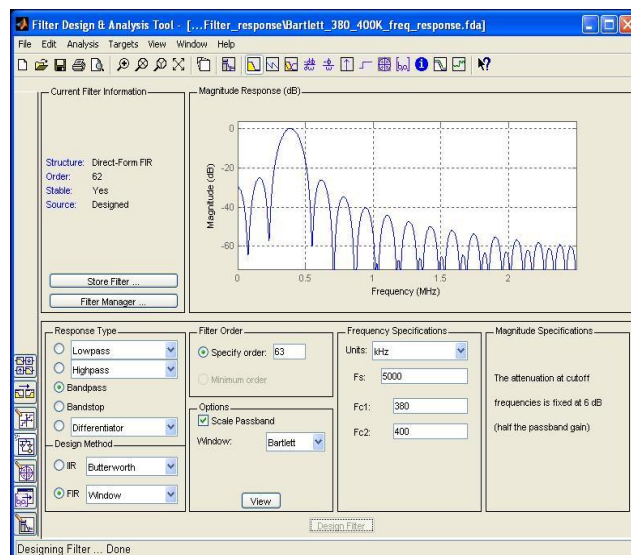


Figure 2 Software base Bartlett frequency Response

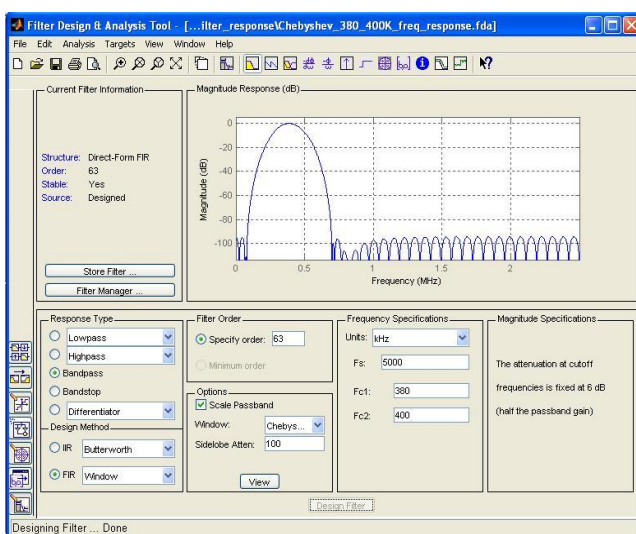


Figure 3. Software Base Chebyshev Frequency Response

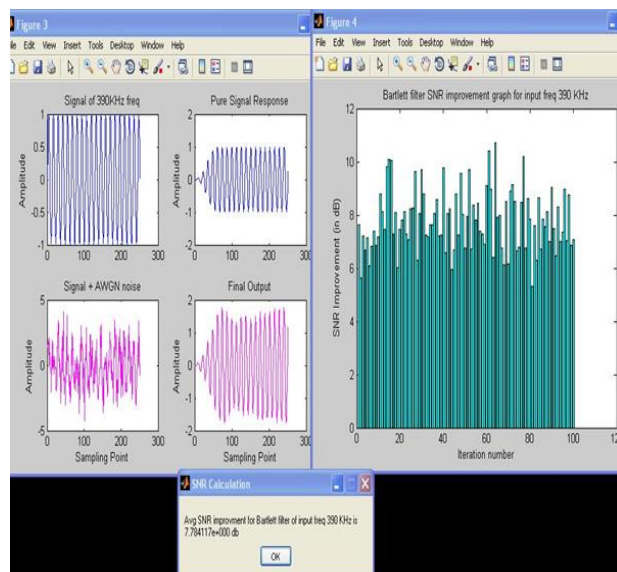


Figure 4. Bartlett SNR

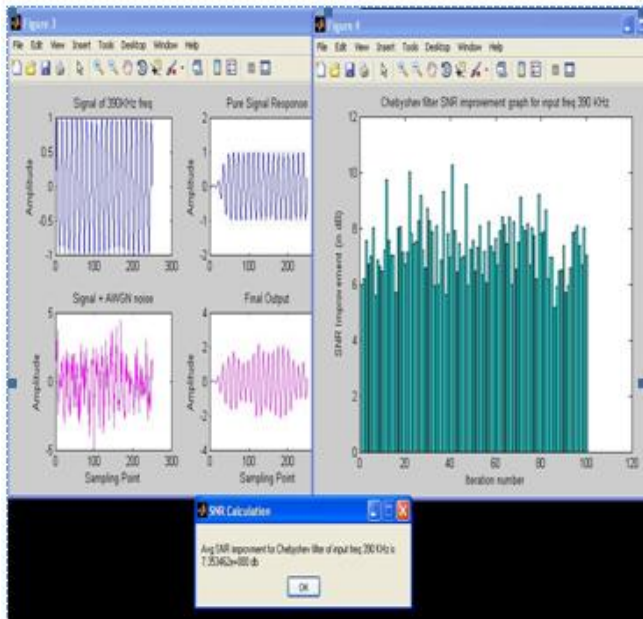


Figure 5. Chebyshev SNR

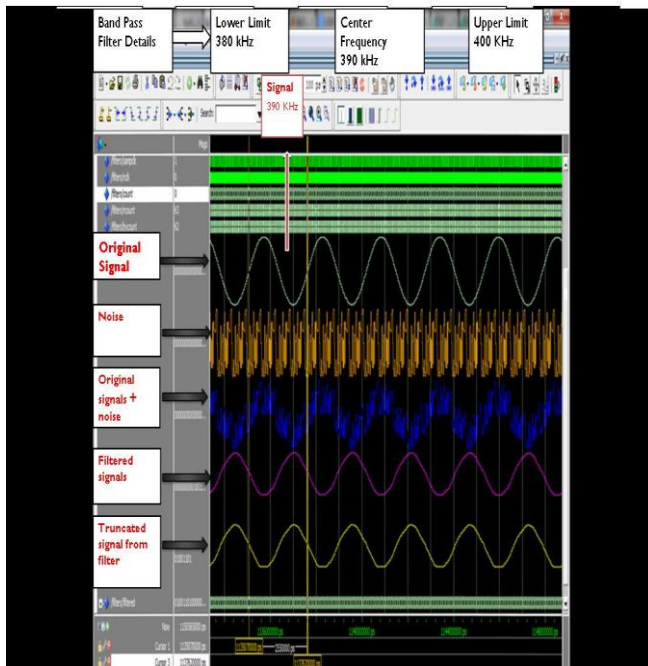


Figure 6. Hardware Base Response

IV. CONCLUSION

Chebyshev and Bartlett FIR band pass 380-400 KHz semi adaptive digital filters design using FPGA kit along with 7 segment display for a sampling frequency of 5 MHz and Analog to Digital & Digital to Analog converters, DIP switches for successfully translated from XILINX and MATLAB software's based design. The hypothetical and realistic filter design reaction was effectively obtained for the designed frequency of 390 KHz. The supremacy presentation of Bartlett above Chebyshev of filter is clearly pragmatic from both kind of design with software & hardware logically from the same designs.

Bartlett type of filter signal to Noise Ratio enhancement factor of 7.76 dB acquire is superior value low frequency band pass semi adaptive filter. Bartlett digital filters are

appropriate for low frequency Radar uses to give the preferred target response and moderate arbitrary noise levels.

In this Paper design a digital filters for radar applications which work in low frequency for the purpose of deep sea bed are suitably demonstrated.

FUTURE SCOPE

This semi adaptive filter design is carried out for low frequency radar application such as deep detection inside the earth. Same approach can be used for high frequency radar employed for imagery mission.

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AUTHORS PROFILE



Dr. Pramila obtained his B.E. in Electronics & communication engineering from Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal, India in 2006 and M.Tech. Degree in Microelectronics & VLSI Design from S.G.S.I.T.S. Indore, India in 2010. He did his Ph.D. in EC from RNTU Bhopal in 2018, He is Member of IFERP.



Dr. Prateek received his Master of Technology from the Department of Electrical Engineering, IIT, Kharagpur (India) and Ph.D from Rabindranath Tagore University, Bhopal. He is currently working as an Associate Professor in the Department of Electrical & Electronics Engineering in Bansal College of Engineering, Mandideep. He is also a senior member of IETE and IFERP. His research interests include Renewable Energy, Instrumentation & Control, wireless communication and power system stability.



Dr. Parashuram is a post graduate from IIT- Kanpur (India) and he did his Ph D in Electronics and Communication from UIT RGPV, Bhopal. He has served in Indian Air Force as commissioned officer for 25 yrs, and nine yrs, as a technocrat academician in reputed Engg. Institutes. He is an entrepreneur who has many project patents under his name. He is a fellow of IETE.