

Remove Noise From Input Signal by Using IIR and FIR Filter Combined Circuit

Kavita Baghel¹ and Brijendra Mishra²

Department of ECE^{1,2}

Nagaji Institute of Technology Management Gwalior, MP, India

Abstract: Filters plays vital role in digital signal processing for filtering the signal and get filtered signal from the noisy signal. Measured signal is damaged by noise and this signal cannot be utilized for analysis and for this reason it is required to restore it. Noise source was not detected. Therefore, the only conceivable solution is to filter the observed signal. We designed the IIR and FIR filter combined circuit after that we add random noise in the signal and in MATLAB software we get filtered signal from the noisy signal and we get the desired result by MATLAB software in simulation environment in the lab.

Keywords: FIR (finite impulse response), AWGN (adaptive white Gaussian noise), DSP, LPF (low pass filter), VT (virtualization tool), (A/D) Analog to Digital converter, IIR (infinite impulse response)

I. INTRODUCTION

Communication is the process in which two sides firstly is called transmitter and secondly is called receiver connect with each other by any communication medium like telephone, mobile, internet services any other mode of communication signals and sharing information with each other in the form of voice, messages, text and any other digital form it is called communication [1]. Radiotelephony, Navigation system wireless communication leased line satellite communication internet messaging online video conference and any other things various types of mode of communication in communication system encoder and decoder worked. The working of encoder is called encryption and the working of decoder is called description [2,3].

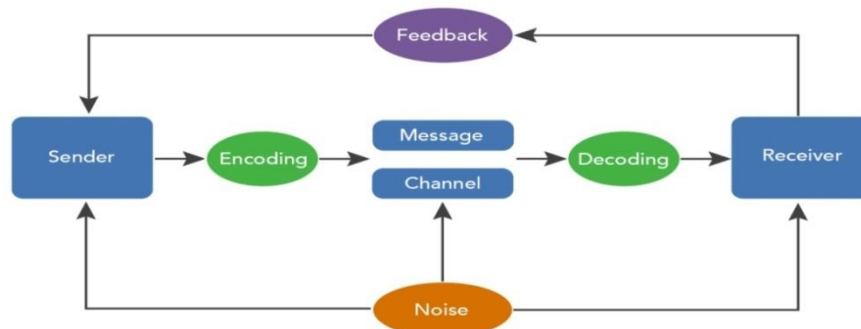


Figure 1: Communication system

II. RELATED WORKS

Activity of displacement actuator has been monitored through utilizing the measurement data collection card into PC. Measured signal is damaged by noise and this signal cannot be utilized for analysis and for this reason it is required to restore it. Noise source was not detected. Therefore, the only conceivable solution is to filter the observed signal [11,12].

The measured signal was captured in a file and its offline processing is thus feasible extra. Offline data processing may be done by using of simulation model figure with data recorded from actual process. The trajectory of the measured signal figure is wavy, and this shows the existence of higher frequencies in the signal. For this reason, a frequency analysis was done figure according to which the individual frequencies of the signals contained in the observed course were identified. Various types of filters are found in digital signal processing there are low pass, high pass, band pass and band stop filter. Low pass filters works only very low frequency signals [4,5].

Below given cutoff frequency true to its output it's always exclude high frequencies low pass filters is very useful in digital signal processing because its restricted the frequency transmission range in transmitting and receiving of audio signals[13]. Low pass filter widely used in telephone lines for limited the frequency range of audio signals and it is useful in many applications in digital signal processing on the other hand high pass filter shows opposite behavior compared to low pass filter because it is always required to reject the frequency component below threshold frequency and always work frequency component above threshold frequency High pass filter filtering the audible sound of 60 Hz AC power “hum” can be considered as noise Designer of cell phone and mobile phone or any other wireless transmitter used analogue band pass filter for its rates radio frequency range It's guaranteed to work in authorized frequency which guide by government department of various countries designers used Band stop filter for communication devices because it is work in authorized frequency range which define according to the set of rule of various countries government quality of band stop filter to work in a Frequency which authorized by government at its pass both low and high frequencies[6,7,8]. Digital filters work on the principle of two method firstly which is called convolution also it is called FIR and by recursion which is called IIR convolution filters or perform much better than recursive filters but Run very slowly in other words we can say that performing of convolution filter Much better than recursive filters but convolution filters works slowly In digital signal processing the digital filters classified in two ways the first one is the FIR and second is IIR [9, 10].

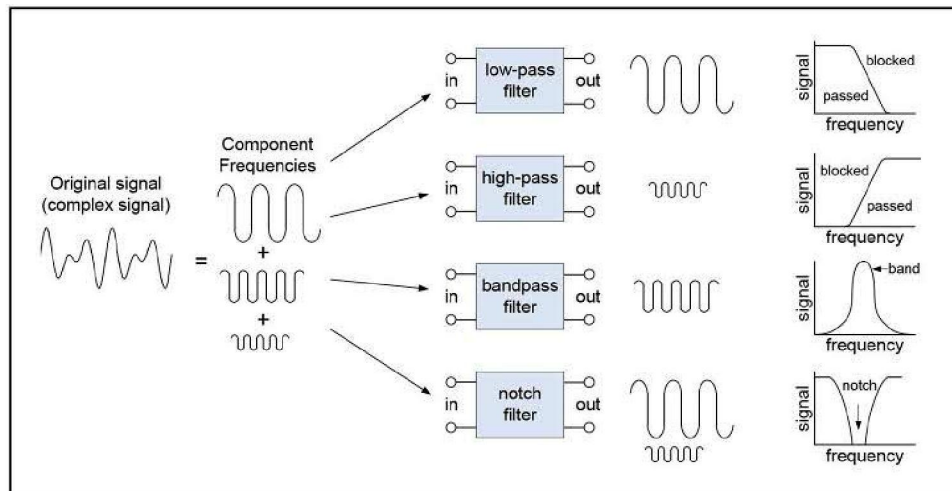


Figure 2: Types of filters in digital signal processing

III. PROPOSED MODEL

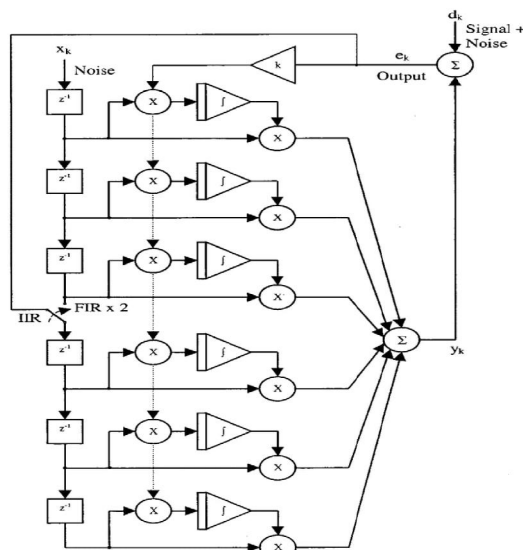


Figure 3: Combined FIR and IIR filter circuit with random noise

IV. SIMULATION AND RESULTS

We obtain the IIR (infinite impulse response) Butterworth LPF and FIR finite impulse response low pass filter via windowing Technique final filter signal from noisy signal in MATLAB programme we add both [14,15,16] FIR and IIR filter in a circuit and When we add random noise in noisy signal of combined circuit of IIR and FIR filter in MATLAB and we take following parameters of noise signals $F_s=500$ Hz, $f=20$ Hz and We take noise ratio $n=\{1/F_s:1\}$, in MATLAB software.

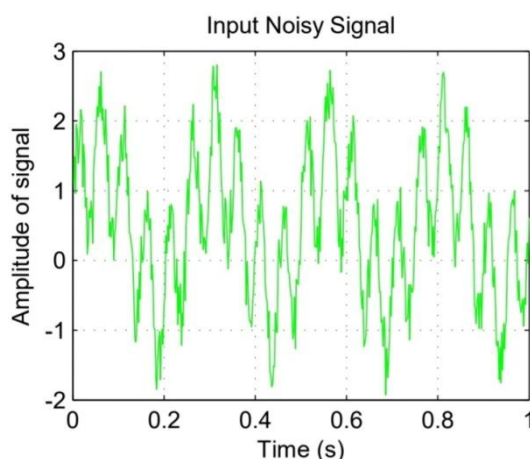


Figure 4: Combined FIR and IIR filter circuit with input random noise signal in MATLAB

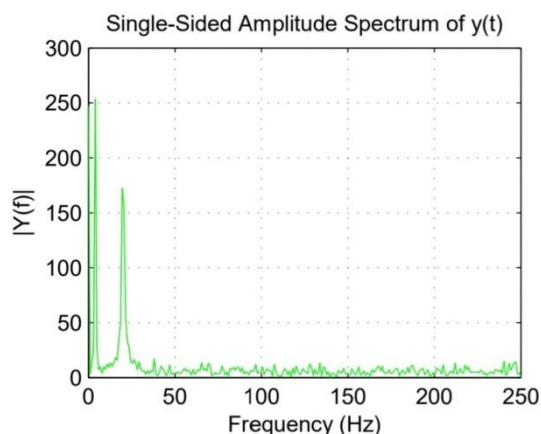


Figure 5: Single side amplitude spectrum of y(t)

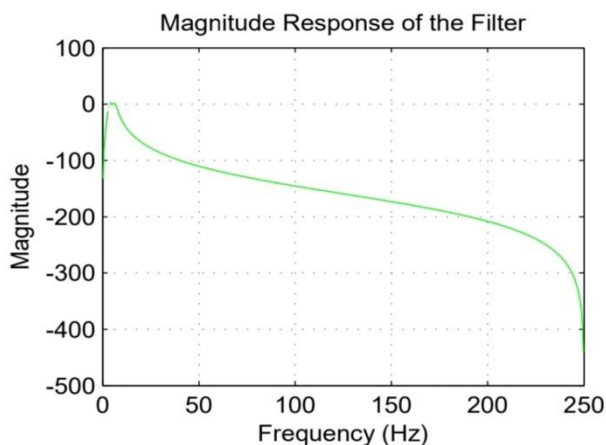


Figure 6: Filter magnitude response

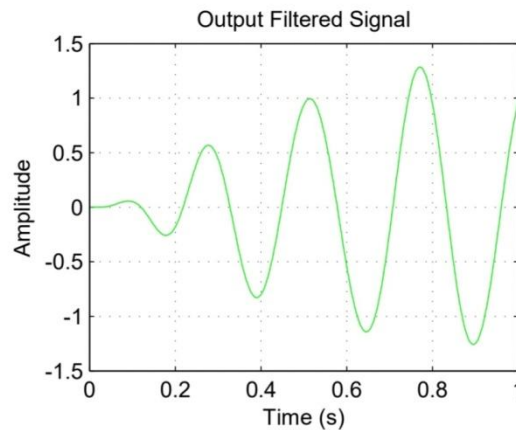


Figure 7: Output filtered signal of combined IIR and FIR circuit

After that we simulate in FIR and IIR filter combined circuit and we add random noise in this circuit after that we simulate this in MATLAB software we used core i3 11th generation processor for simulation in computer lab after simulation we get the desired result from MATLAB software We get filtered signal from unfiltered signal or noisy signal. In signal processing, White noise is a random signal with equal strength at various frequencies. White noise is a type of random signal which shows equal strength with various given frequencies and it always gives constant power spectral density.

V. CONCLUSION

Following conclusion may be reached from the above investigations. We designed the IIR and FIR filter combined circuit and add random noise in the signal and in MATLAB software after simulation we get filtered signal from the noisy or unfiltered signal and we get the desired result by MATLAB software in simulation environment in the lab. signals plays vital role in communication system in communication signals are distorted and become noisy due to come in the contact of noisy signal in that circumstances some part of the signal are damaged and lost in that circumstances it is important to repair that's signal or restored. Filtering is the only way by which we can do this work and we get the restored and filter signal from the noisy and unfiltered signal in signal processing. Researchers and scientist may be adopted new research technologies and methodology for filtering the signal and improve the quality and efficiency of the signals in communication system in the future. Because without filtering the signal we can't reach the vital and robust solution off improving signals quality in signal processing in communication system

REFERENCES

- [1]. P. Flandrin, G. Rilling and P. Goncalves, "Empirical mode decomposition as a filter bank," in IEEE Signal Processing Letters, vol. 11, no. 2, pp. 112-114, Feb. 2004, doi: 10.1109/LSP.2003.821662.
- [2]. Boudraa, Abdel-O & Cexus, Jean-Christophe. (2006). Denoising via empirical mode decomposition. Second International Symposium on Communications, Control and Signal Processing.
- [3]. A. Boudraa and J. Cexus, "EMD-Based Signal Filtering," in IEEE Transactions on Instrumentation and Measurement, vol. 56, no. 6, pp. 2196-2202, Dec. 2007, doi: 10.1109/TIM.2007.907967.
- [4]. K. Khaldi, A. Boudraa, A. Bouchikhi, M. Turki-Hadj Alouane and E. S. Diop, "Speech signal noise reduction by EMD," 2008 3rd International Symposium on Communications, Control and Signal Processing, Saint Julian's, Malta, 2008, pp. 1155-1158, doi: 10.1109/ISCCSP.2008.4537399.
- [5]. S. K. Kopparapu and M. Satish, "Identifying Optimal Gaussian Filter for Gaussian Noise Removal," 2011 Third National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics, Hubli, India, 2011, pp. 126-129, doi: 10.1109/NCVPRIPG.2011.34.
- [6]. R. J. Barsanti and J. Gilmore, "Comparing noise removal in the wavelet and Fourier domains," 2011 IEEE 43rd Southeastern Symposium on System Theory, Auburn, AL, USA, 2011, pp. 163-167, doi: 10.1109/SSST.2011.5753799.

- [7]. Singh, Manjeet & Garg, Er.Naresh. (2014). Audio Noise Reduction Using Butter Worth Filter. International Journal of Computer & Organization Trends. 6. 20-23. 10.14445/22492593/IJCOT-V6P305.
- [8]. Afroz, Farhana & Huq, Asadul & F, Ahmed & Sandrasegaran, Kumbesan. (2015). Performance Analysis of Adaptive Noise Canceller Employing NLMS Algorithm. International Journal of Wireless & Mobile Networks. 7. 45-58. 10.5121/ijwmn.2015.7204.
- [9]. A. N. Untwale and K. S. Degaonkar, "Survey on noise cancellation techniques of speech signal by adaptive filtering," 2015 International Conference on Pervasive Computing (ICPC), Pune, India, 2015, pp. 1-4, doi: 10.1109/PERVASIVE.2015.7086974.
- [10]. C. Haritha, M. Ganesan and E. P. Sumesh, "A survey on modern trends in ECG noise removal techniques," 2016 International Conference on Circuit, Power and Computing Technologies (ICCPCT), Nagercoil, India, 2016, pp. 1-7, doi: 10.1109/ICCPCT.2016.7530192.
- [11]. K. R. Kumar, R. Anand and R. Gandhiraj, "Implementation of noise cancellation using least mean square in GNU radio," 2017 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, 2017, pp. 1-5, doi: 10.1109/ICCCI.2017.8117786.
- [12]. Digital Signal Processing by salivahanan, vallavaraj gnanapriya Published by TaTa mcgraw Hill Publications.
- [13]. Analog communication by Sanjay Sharma published by Katariya Publications.
- [14]. Manjinder Kaur, Sangeet Pal Kaur, "FIR Low Pass Filter Designing Using Different Window Functions and their Comparison using MATLAB", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, Issue 2, February 2016.
- [15]. Alexander H. Reyes, Edgar Sánchez-Sinencio, and Francisco Duque-Carrillo by "Analog Implementation of an Active Noise Controller System for Portable Audio Applications" published in IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS—II: ANALOG AND DIGITAL SIGNAL PROCESSING, VOL. 48, NO. 4, APRIL 2001
- [16]. Pavitra Shukl, Member, IEEE and Bhim Singh, Fellow, IEEE by "Combined IIR and FIR Filter for Improved Power Quality of PV Interfaced Utility Grid" published in DOI 10.1109/TIA.2020.3031875, IEEE November 10,2020 at 22:47:48 UTC from IEEE Xplore.