



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



---

# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 5      Issue: III      Month of publication: March 2017**

**DOI: <http://doi.org/10.22214/ijraset.2017.3108>**

**[www.ijraset.com](http://www.ijraset.com)**

**Call: ☎ 08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**

# **Design of High Pass FIR Filter using Rectangular and Taylor Window Method**

Hardip Miri<sup>1</sup>, Yogendra Karsh<sup>2</sup>, Rahul Suryawanshi<sup>3</sup>, Rajesh suryawanshi<sup>4</sup>, Pranay Kumar Rahi<sup>5</sup>  
<sup>1,2,3,4,5</sup> Department of Electrical and Electronics Engineering, <sup>5</sup>Guru Ghasidas University, Bilaspur Chhattisgarh

**Abstract:** In this paper a window function has been defined and simulated. In the initial section the frequency response of the four basic types of FIR filter have been simulated using the window function. Then the fir filter responses are compared with those using Taylor window and Rectangular window function. Improved frequency response have been observed, the frequency response of the new window function will be compared with other common window function in near future with generalized and quantized experimental results.

**Keywords:** DSP, Digital Filter, High Pass Filter, FIR, Rectangular Window and Taylor Window.

## **I. INTRODUCTION**

Signal processing is a method of extracting information the signal which in turn depends on the type of signal and the nature of information it carries. Thus signal processing is concerned with representing signals in mathematical terms and extracting the information by carrying out the algorithmic operation on the signal [1].

Digital processing of a signal facilitates the shearing of a signal processor among a number of signal by time- shearing .This reduces the processing cost, size, weight and maintenance per signal. Also DSP can save both filtered and unfiltered data for further use [2]. A digital filter is a mathematical algorithm implemented in hardware/software that operates on a digital input to produce digital output. Digital filter play very important roles in DSP [3].

### *A. Advantages*

- 1) Digital filters can have characteristics are not possible with analog filters such as linear phase response.
- 2) Several input signals can be filtered by one digital filter without the need to replicate the hardware.
- 3) Digital filters can be used at very low frequencies.

### *B. Disadvantages*

Speed limitation , Finite word length effects and Long design and development time.

### *C. Applications Of DSP*

1) *Signal Processing Applications:* There are numerous applications of signal processing that we often encounter in our daily life without being aware of them. Originally the signal processing algorithms used in these applications were carried out in the continuous time domain. It is not possible to discuss all of these applications. However an overview of selected applications is presented.

- a) *Sound Recording Application:* The recording of most musical programs now a day is usually made in acoustically inert studio. The sound from each instrument is picked up by its own microphone closely placed to the instrument and is recorded on a single track in a multi-track tape recorder containing us many us 48 tracks. The signals from individual tracks in the master recording are then edited and combined by the sound engineer in a mix-down system to develop a two-track stereo recording.
- b) *Telephone Dialing Application:* Signal processing plays a key role in the detection and generation of signaling tones for push-button[DAR76]. Seven frequencies are used to code the 10 decimal digits and the two special buttons marked “ \* “ and “ # “ . The low – band frequencies are 697 Hz, 770 Hz, 852 Hz, and 941 Hz. The remaining three frequencies belonging to the high band are 1209 Hz, 1336 Hz and 1477 Hz.
- c) *FM Stereo Applications:* For wireless transmission of a signal occupying a low frequency range, such as an audio signal, it is necessary to transform the signal to a high frequency range by modulating it onto a high frequency carrier. At the receiver , the modulated signal is demodulated to receiver the low frequency signal. The signal processing operations used for wireless

# International Journal for Research in Applied Science & Engineering Technology (IJRASET)

transmissions are modulations, demodulations, and filtering

## II. WINDOW METHOD

These are the window method frequency sampling method and optimal or minimax design. The window method involves a straight forward analytical procedures, however, in some cases, iteration is necessary to obtained the desired results. Several windows are considered.

### A. Rectangular Window

The relation expressed in equation can also be obtained by multiplying the sequence  $h_d(n)$  by the sequence  $w_R(n)$  defined by

$$w_R(n) = \begin{cases} 1 & 0 \leq n \leq N-1 \\ 0 & \text{otherwise} \end{cases}$$

because of its appearance  $w_R(n)$  is called rectangular window.

### B. Taylor Window

The Taylor window function for total number of samples,  $N = 10$  is shown in figure. The sample points ( $n$ ) are indicated along  $x$  – axis and the corresponding amplitude levels along  $y$  – axis respectively

PARAMETER	VALUES
Sampling Frequency( $f_s$ )	35000
Cut off Frequency( $f_c$ )	8200
Order( $N$ )	10

Table 1: Parameter Specification.

### C. Simulation and Result

S. No.	Frequency	Window Method	
		Rectangular (In dB)	Taylor (In dB)
1.	$0.1 \pi$	9.5502	9.6756
2.	$0.2 \pi$	7.0171	7.8320
3.	$0.3 \pi$	5.0901	-9.7399
4.	$0.4 \pi$	3.0329	-9.5389
5.	$0.5 \pi$	2.9796	-10.8655
6.	$0.6 \pi$	1.0134	-11.6542
7.	$0.7 \pi$	0.3965	-11.9767

Table 2: Filter Magnitude of Rectangular and Taylor Window Technique .

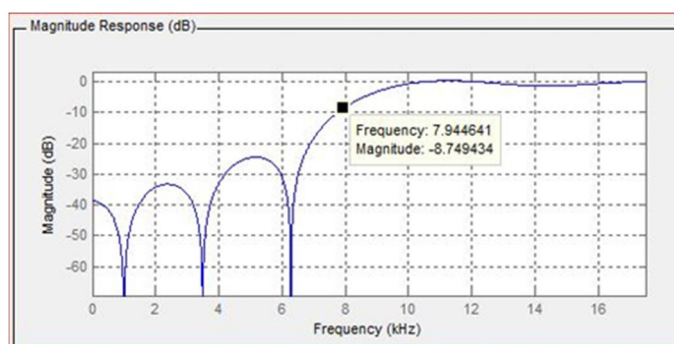


Figure 1: Magnitude response of Rectangular Window Technique.

# International Journal for Research in Applied Science & Engineering Technology (IJRASET)

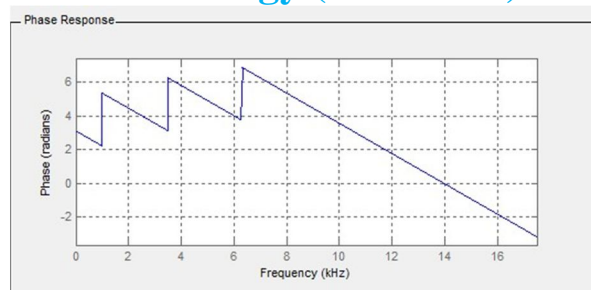


Figure 2: Phase response of Rectangular Window Technique.

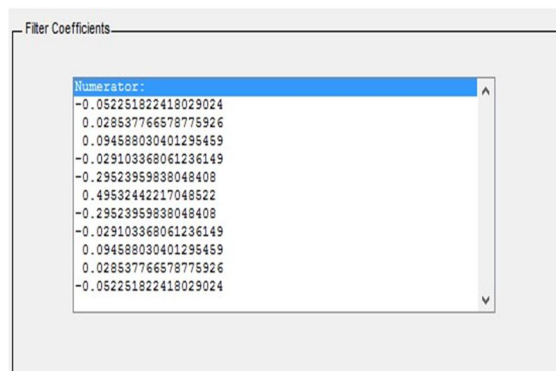


Figure 3: Filter coefficient of Rectangular Window Technique.

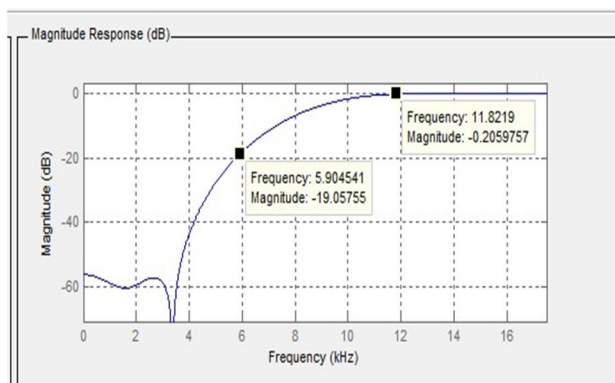


Figure 4: Magnitude response of Taylor Window Technique.

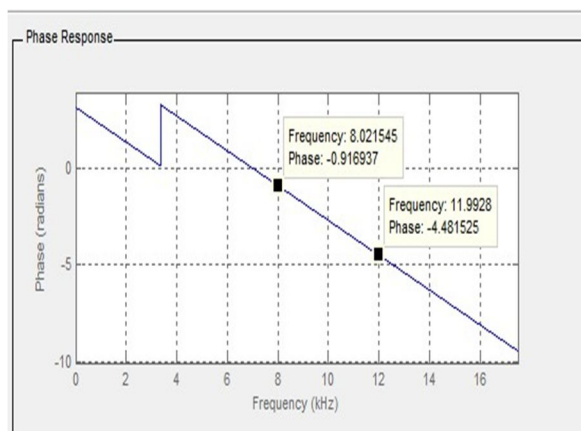


Figure 5: Phase response of Taylor Window Technique.

## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

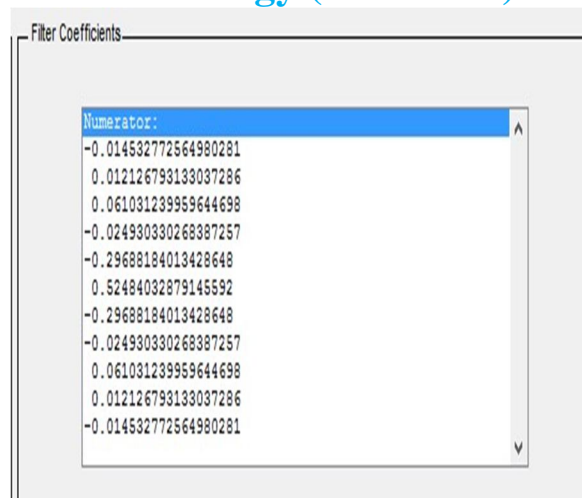


Figure 6: Filter coefficient of Taylor Window Technique.

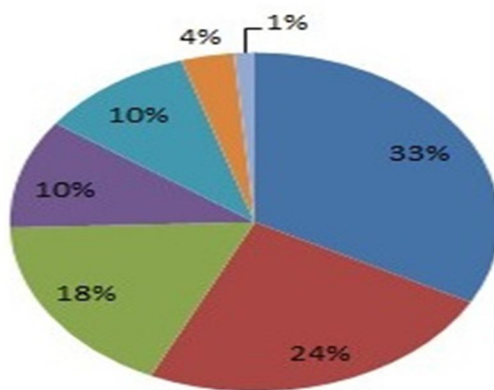


Figure 7: Magnitude and Frequency plot of Rectangular Window Technique.

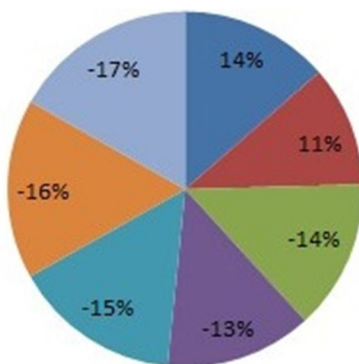


Figure 8: Magnitude and Frequency plot of Taylor Window Technique.

### III. CONCLUSIONS

In this research paper High pass FIR Filter has been designed by using Rectangular and Taylor Window Technique. We observed that Taylor Window Technique shows better response than Rectangular Window Technique in terms of magnitude and phase responses.



# International Journal for Research in Applied Science & Engineering Technology (IJRASET)

## IV. ACKNOWLEDGMENT

I am greatly thankful to Mr. Pranay Kumar Rahi (Registrar & Assistant Professor, Department of Electrical & Electronics Engineering, I. T. KORBA) The authors would thank the Electrical and Electronics Engineering. Department of the institute support and facilities to be provided during the research and simulation work.

## REFERENCES

- [1] Sanjit K. Mitra "digital signal processing" a computer based Approach 2<sup>nd</sup> Edition McGraw Hill, pp.1.
- [2] Michael Weeks, "digital signal processing" Using MATLAB and Wavelets, 2007 edition, Infinity Science Press, pp.
- [3] S Salivahanan, C Gnanapriya, A Vallavaraj, "digital signal processing" Tata McGraw-Hill, 2<sup>nd</sup> Edition pp.3.443-448
- [4] John G. Proakis, Dimitris G. Manolakis, "digital signal processing" PEAESON, fourth edition
- [5] Sen M Kuo, Bob H Lee, "digital signal processing" John Wiley & Sons, 2001 edition
- [6] Richards G. Lyons, Understanding digital signal processing" PEARSON, second edition
- [7] A Nagoor Kani, "digital signal processing" McGraw-Hill Education, second edition
- [8] Alan V. Oppenheim, Ronald W. Schaffer, "digital signal processing", PEARSON education, 2015 edition
- [9] Steuen W. Smith, "digital signal processing", Elsevier, 2005 edition.
- [10] Emmanuel Ifeachor, Barry W. Jervis, "digital signal processing" PEARSON, second edition.

## AUTHOR DETAILS



Pranay Kumar Rahi received the Bachelors of Technology in Electronics and Telecommunication Engineering from Government Engineering College, Guru Ghasidas University, Bilaspur, Chhattisgarh India in 2004, and pursuing Masters of Engineering from National Institute of Technical Teacher's Training & Research, Punjab University, Chandigarh, India. Presently working as Assistant Professor in Department of Electrical and Electronic Engineering, Institute of Technology Korba, Chhattisgarh since 2008. He has authored more than 14 research publications and published Journal papers in the leading International and National journal. His primary research interest includes Digital Signal Processing, VLSI Design, Control Systems and Digital Electronics and logic design.



**Rahul Suryawanshi** pursuing Bachelor of Engineering in Elecctrical and Electronics Engineering in 7<sup>th</sup> semester, from Institute of Technology Korba, Chhattisgarh Swami Vivekananda Technical University, Bhilai, Chhattisgarh, India.



**Hardip Miri** pursuing Bachelor of Engineering in Electrical and Electronics Engineering in 5<sup>th</sup> semester, from Institute of Technology Korba, Chhattisgarh Swami Vivekanand Technical University, Chhattisgarh, India.



**Yogendra Karsh** pursuing Bachelor of Engineering in Electrical and Electronics Engineering in 5<sup>th</sup> semester, from Institute of Technology Korba, Chhattisgarh Swami Vivekanand Technical University, Chhattisgarh, India.



**Rajesh Suryawanshi** received the Bachelors of Engineering in Electrical and Electronics Engineering from Institute of Technology Korba College, Chhattisgarh Swami Vivekananda Technical University, Bhilai, Chhattisgarh, India.



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)