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A New Class of Combined Bartlett-Blackman Window Family

Madhur Jain[*1], Sandeep Kumar Arya[2], Rohit Gurjar[3], Arpit Rawat[4]
[*1,2,3,4] Department of Electronics and Communication Engineering, Jaypee University of Engineering &
Technology, Guna (M.P), India
madhurjain2110@gmail.com

Abstract
In this correspondence, by using the concept of the modified Bartlett-Hanning (MBH) window is extended to the form of designing of new combination of window which is "The Modified Bartlett-Blackman (MBB) window" and its spectral behavior is investigated. It is found that with the parameters m, b adjust to different values, this window family can attain a minimum half main lobe width of 2.75, a maximum sidelobes level(MSLL) of – 71.81 dB and maximum first sidelobes level(FSLL) of -80.63 dB. The extended MBB window family is also analyzed on other useful parameters with the conventional window.

Keywords: First sidelobes level (FSLL), Maximum sidelobes level (MSLL), The Modified Bartlett-Blackman (MBB), Half main lobe width (HMLW).

Introduction

Window functions have played a vital role in digital signal processing and found extensive applications in signal analysis and estimation, digital filter design and speech processing [1]. An exhaustive review of many window functions and their properties was presented by Harris [2]. Consequently, a good number of window functions have been proposed in the literature [3]-[5] and discussions on this topic have been going on quite intensely. A classification of all available window functions is given in [6]. Such window functions should have acceptable figures of merit depending upon the applications. However, most of the window functions usually have a tradeoff between the half main lobe width (HMLW) and maximum side lobe level (MSLL). In the same context, Ha and Pearce [7] proposed the modified Bartlett-Hanning (MBH) window and made a comparative study with fixed windows [6]. However, according to their definition the variable (ξ) can vary from 0.00 to 1.00 and so the HMLW and MSLL, respectively. In fact, this variable can take values more than 1.00 and the window family can attain a narrower HMLW, improved MSLL and better first side lobe level (FSLL) for different values of said variable. In this correspondence, the definition of original MBB window is defined by using the concept of combining the window.

Window Definition and Parameters

Within the constraints of the concept of window function The Modified Bartlett-Blackman (MBB) window is defined as:

$$w(t) = \left[b - \frac{\left| n - \frac{M-1}{2} \right|}{\frac{M-1}{2}} \right] + [1 - mb^2][0.42 - 0.5\cos\frac{2\pi n}{M-1} + 0.8\cos\frac{4\pi n}{M-1}]$$

$$(1)$$

Hear b and m are the variable of MBB window function 1≤b≤4 and 1≤m≤100 if b=1 and m=1 then equation (1) is treated as just like Ideal Bartlett window shown in Fig.1.
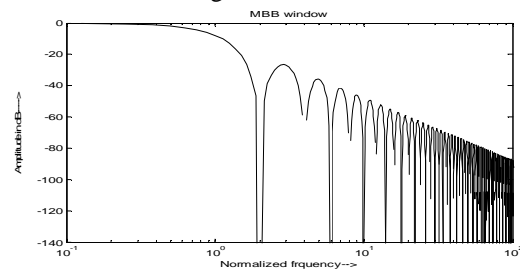

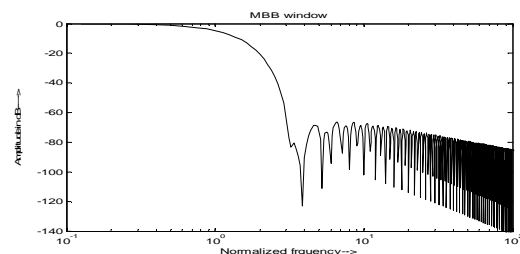**Fig.1: The MBB window is like Bartlett window at b=1 and m=1**

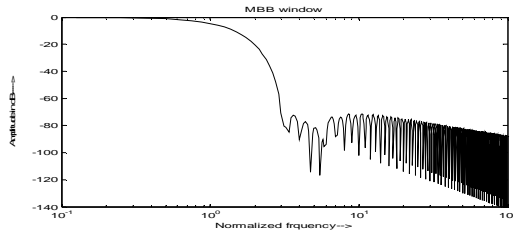**Fig.2: The MBB window having maximum FSLL at b=1.45 and m=31**

Fig.3: The MBB window having MSLL at b=1.9 and m=45

Comparison of Windows

WINDOW	MSLL (dB)	FSLL (dB)	HMLW
Rectangular	-13	-13	0.81
Cosine-tip	-23	-23	1.35
Bartlett b=1,m=1	-26 (Fig.1)	-26	1.63
Hanning (α=0.5)	-31.47	-31.47	1.87
Blackman	-58	-58	2.82
Proposed Family (MBB)	-71.81 (Fig.2)	-80.63 (Fig.3)	2.875

The Simulated Study and Result

The MBB window having some useful property reported hear as follow:-

1. There is tradeoff between the levels of first and second sidelobes and parameters of Window (b and m).when the parameters value is increase then the values of First side Lobe Level is increases and the second side lobe level is decrease.
2. From the generated window with better FSLL than MSLL, useful for the applications Where close by interference rejection is required [13], the optimum value of FSLL, i.e -80.63 **dB,** can be achieved by keeping $b = 1.45$ and m= 31 as shown in Fig.2.
3. From the generated window we will find the MSLL is about -72 dB (approx.) by keeping, b=1.9 and m= 45 as shown in Fig.3.
4. By following (1) to (3) above, this resultant window is superior than Blackman window in the sense of FSLL and MSLL.

Conclusion

The definition of MBB window is defined and its improved spectral response is reported. The MBB window family can attain a MSLL of -71.81 dB and HMLW of 2.875 and FSLL of -80.63 dB which is better than both of the Bartlett as well as Blackman window.

References

[1] L.R.Rabiner and B. Gold, *"Theory and Applications of Digital Signal Processing.* Englewood Cliffs," NJ: Prentice-Hall, 1975.

[2] F. J. Hams, "On the use of windows for harmonic analysis with the discrete Fourier transform," *Proc. IEEE,* vol. 66, pp. 51-83, Jan. 1978.

[3] S. Yang and Y. Ke, "On the 3-coefficients window family," *IEEE Trans. Signal Processing,* vol. 40, pp. 3085-3088, Dec. 1992

[4] F. I. Tseng, T. K. Sarkar, and D. D. Weiner, "A novel window for harmonic analysis," *IEEE Trans. Acoust., Speech, Signal Processing,* vol. ASSP-29, pp. 177-188, Apr. 1981

[5] J. Zhong, 2. Han, and W. Lu, "Design of windows with steerable sidelobe dips," *IEEE Trans. Signal Processing,* vol. 40, pp. 1452-1458, June 1992.

[6] J. K. Gautam, A. Kumar, and R. Saxena, "WINDOWS: A tool in signal processing," *IETE Tech. Rev.,* vol. 12, no. **3,** pp. 217-226, May/June 1995.

[7] Y. H. Ha and J. **A.** Pearce, "A new window and comparison to standard windows," *IEEE Trans. Acoust., Speech, Signal Processing,* vol. 37, no. 2, pp. 298-301, Feb. 1989.