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# Hybrid Windowing Adaptive FIR Filter Technique In Underwater Communication

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## Abstract

In underwater communication, acoustic signals have been more effective than the radio frequency signals. Hence acoustic waves have been propagates over a very short distances. Hybrid windowing FIR filter with adjustable co-efficient and weight updating block utilized to adjust the filter coefficients This proposed work is focus on underwater ambient noise reduction using proposed variable Adaptive filter. Generally, noise reduction techniques have been developed based on the minimization of SNR such as wavelet based de-noising technique for wind noise reduction with improved SNR of 7dB-10dB.

**Keywords:** Adaptive FIR filter, SNR, MATLAB.

## 1. Introduction

In [1] described the integrated and a systematic signal account and data processing of the ocean environment is provided. In [2] described the adaptive beamforming, utilizes the adaptive canceler approach /dipole pattern method, and at last combines these approaches. In [3] describes the general idea of signal processing methods and advances in underwater acoustic communications. Also , described up-and-coming multicarriers techniques and single carrier techniques with spatial multiplexing and iterative decoding methods. In [4] described the channel modeling of underwater acoustic as well as threshold signal processing. Provided the incoherent and coherent modes of reception.

## 2. Proposed Method

Hybrid window function and then they are updated using adaptation algorithm, as a result the convergence becomes fast and the number of iteration has been reduced. The intended hybrid window is a combination of Blackman & Hamming window which is

$$w(n) = \{[0.54-0.46\cos(2\pi n/N-1)] * [0.42-0.5\cos(2\pi n/N-1)+0.08\cos(4\pi n/N-1)]\}, \quad 0 = n = N-1$$
$$1 \qquad 0, \qquad \text{Otherwise} \tag{1}$$

$$w(n)=\{[0.3418-0.4816\cos(2\pi n/N-1)+ 0.1582\cos(4\pi n/N-1) - 0.0184\cos(6\pi n/N-1)]\}, \quad 0 = n = N-1$$
$$0, \qquad \text{Otherwise} \tag{2}$$

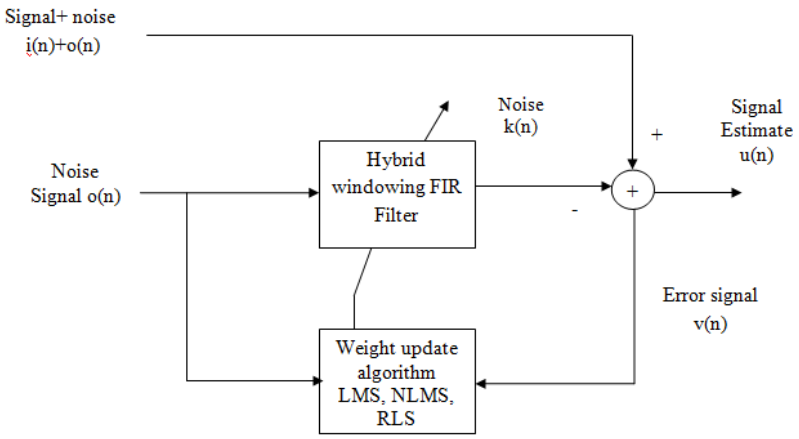


**Figure.1 Proposed Hybrid Window Approach**

In the proposed work, noise estimate k(n)has been generated from the observation of input noise o(n) using linear model such as digital FIR filter which is subtracted from the desired signal d(n) which is made up of signal i(n) that is corrupted by noise yields error signal v(n) is also called as signal estimate u The obtained error has been given to weight adaptation block for updating the filter co-efficient in order to reduce the difference between desired signal and filter output. This updating process continuous until the filter co-efficient converges to reduce the noise in the desired signal.

## 3. Results and Discussion

The proposed window and existing windows for order N=35 are simulated in MATLAB. Figure 2 shows the conventional frequency response of the hanning window. Figure 3 shows the frequency response of low pass filter using Hanning window.

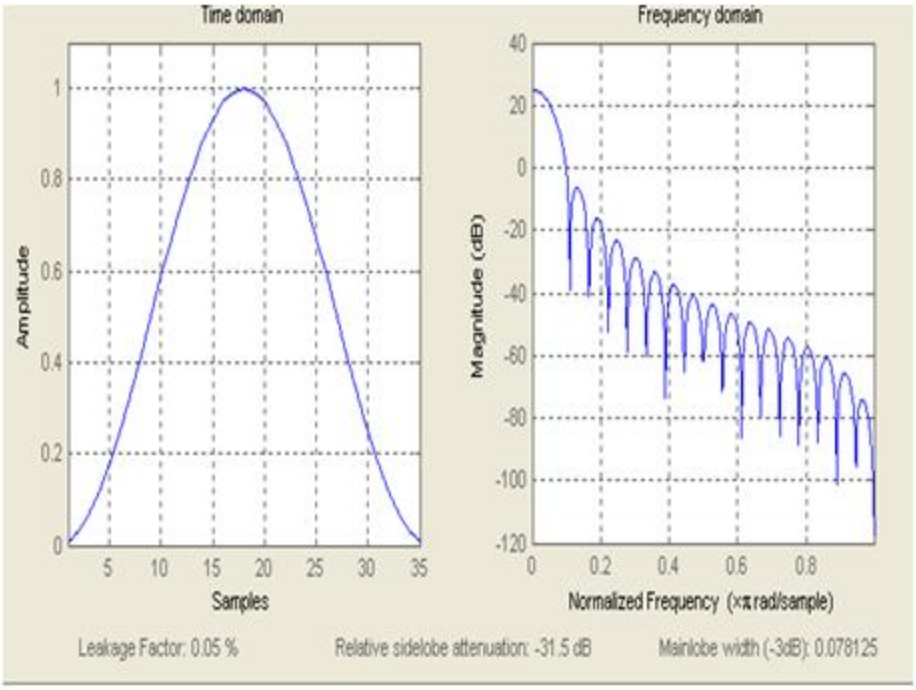


**Figure. 2 Frequency response of Hanning window**

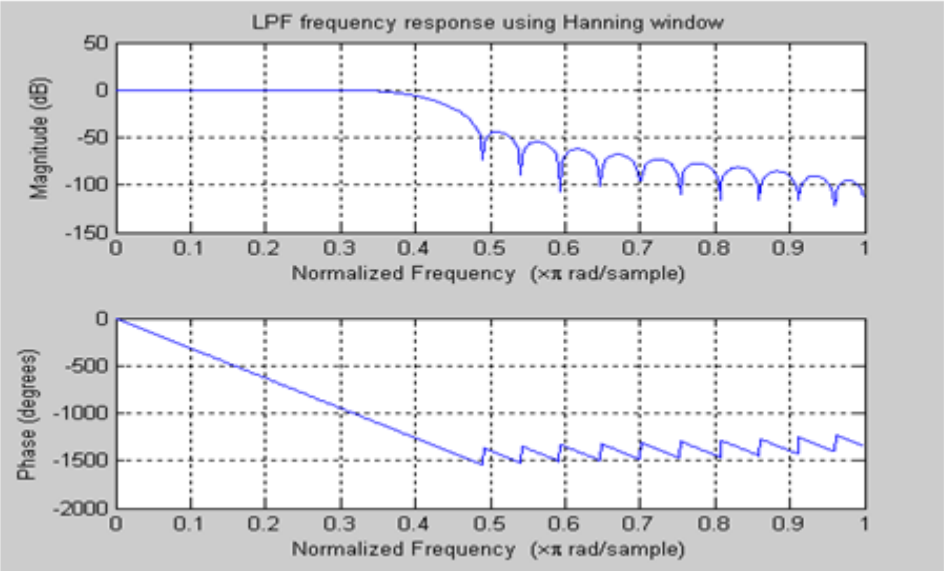


**Figure. 3 FIR –LPF frequency response using hanning window**

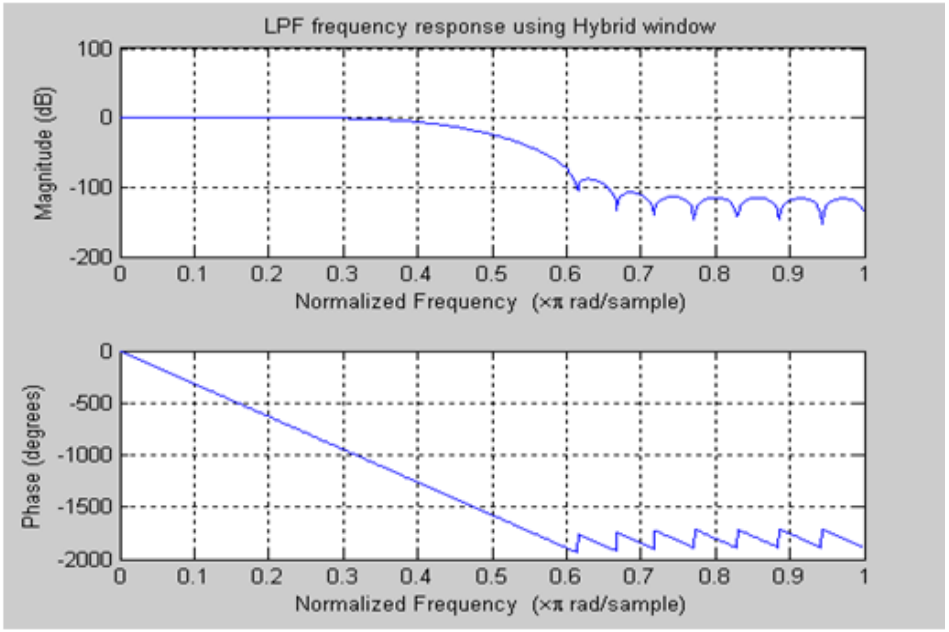


**Figure. 4 FIR –LPF frequency response using hybrid window**

Hannning windows filter design has the same transition width is higher and attenuation of side lobes is large. Whereas the the intended window offers~0.01813to ~0.009 increased width of main lobe and enhancement of -21.2 dB in the reduction on side lobe.

## 4. Conclusion

In this paper the A Hybrid window technique was applied on proposed Adaptive filter to reduce the number of iteration into less than 90 for denoising the underwater acoustic signal. The proposed method is implemented using MATLAB. The Proposed filter provides high degree of reconstruction with significantly improved SNR.

## References

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