Scientific Journal of Impact Factor (SJIF) : 3.134

ISSN (Print): 2348-6406
ISSN (Online): 2348-4470

International Journal of Advance Engineering and Research Development

ADAPTIVE NOISE CANCELLATION USING WEINER FILTER

Ekta[1], Deepti Chaudhary[2]

[1,2] Shree Krishna Institute of Engineering & Technology, Kurukshetra University, Kurukshetra.

Abstract *- This paper defines the concept of adaptive noise cancelling, an alternative method of estimating signals corrupted by additive no`q ise or interference. The method uses a primary input containing the corrupted Signal and a reference input containing noise correlated in some unknown way with the primary noise. The reference input is adaptively filtered and subtracted from the primary input to obtain the signal estimate. Wiener solutions are developed to describe asymptotic adaptive performance and output signal-to-noise ratio for stationary stochastic inputs, including single and multiple reference inputs. These solutions show that when the reference input is free of signal and certain other conditions are met noise in the primary input can be essentially eliminated without signal distortion. It is further shown that in wiener filter with narrow bandwidth, infinite null, and the capability of treating periodic interference the adaptive noise canceller acts as tracking the exact frequency of the interference; in this case the canceller behaves as a linear, time-invariant system, with the adaptive filter results presented that illustrate the usefulness of the adaptive noise cancelling on a dynamic rather than a static solution. In the first stage the narrowband noise is reduced by using the ALE technique. The second stage gets a signal with ideally only the wideband noise which is reduced using the NLMS technique. The reference input is adaptively filtered and subtracted from primary input to obtain signal estimate.*

Keywords: *ANC, NLMS, ALE*

I. INTRODUCTION

I. WIENER FILTER

Wiener filters are a class of optimum linear filters which involve linear estimation of a desired signal sequence from another related sequence. In the statistical approach to the solution of the linear filtering problem, we assume the availability of certain statistical parameters (e.g. mean and correlation functions) of the useful signal and unwanted additive noise. The problem is to design a linear filter with the noisy data as input and the requirement of minimizing the effect of the noise at the filter output according to some statistical criterion. A useful approach to this filter-optimization problem is to minimize the mean-square value of the error signal that is defined as the difference between some desired response and the actual filter output. For stationary inputs, the resulting solution is commonly known as the Weiner filter. Its main purpose is to reduce the amount of noise present in a signal by comparison with an estimation of the desired noiseless signal.

II.NOISE CANCELLATION USING ADAPTIVE FILTERING

With a basic concept first introduced by Widrow, the Adaptive Noise Canceller (ANC) removes or suppresses noise from a signal using adaptive filters that automatically adjust their parameters (Widrow et al. 1975) as shown in figure 1. The ANC uses a reference input derived from single or multiple sensors located at points in the noise field where the signal is weak or undetectable. Adaptive filters then determine the input signal and decrease the noise level in the system output.

The parameters of the adaptive filter can be adjusted automatically and require almost neither prior signal information nor noise characteristics desired noiseless signal.

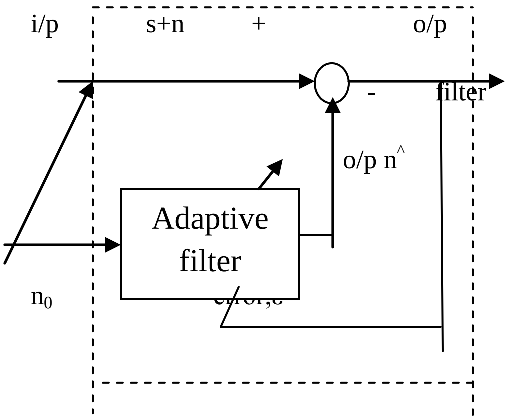


Fig 1. Adaptive Noise Canceller

As shown in the figure, an Adaptive Noise Canceller (ANC) has two inputs – primary and reference. The primary input receives a signal s from the signal source that is corrupted by the presence of noise n uncorrelated with the signal. The reference input receives a noise n0 uncorrelated with the signal but correlated in some way with the noise n. The noise n0 passes through a filter to produce an output n ˆ that is a close estimate of primary input noise. This noise estimate is subtracted from the corrupted signal to produce an estimate of the signal at s ˆ, the ANC system output.

In noise canceling systems a practical objective is to produce a system output s ˆ= s + n – n ˆ that is a best in the least squares sense to the signal s. The objective is accomplished by feeding the system output back to the adaptive filter and adjusting the filter through an LMS adaptive algorithm to minimize total system output power.

III. LITERATURE REVIEW

Xin Wu et. al.[6] has presented an application of adaptive filter in side lobe suppression for radar pulse compression. Traditional, windowing techniques are employed to reduce the side lobe levels in the compressed waveform at the expense of slightly reduced SNR and main broaden pulse width.

Kuthluy$_1$l do gancay et.al.[7] has proposed that in some application of Application of adaptive filtering such as active noise reduction, and network and acoustic echo cancellation, the adaptive filter may be required to have a large number of coefficients in order to model the unknown physical medium with sufficient accuracy.

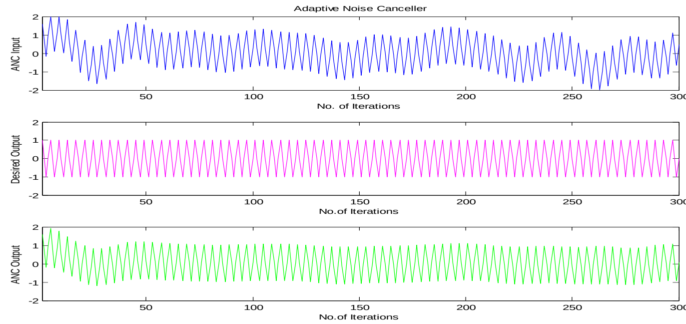
David S. Leeds [8] has described an application of adaptive noise cancellation in the form of an adaptive multiple notch filter, to remove transmitter burst envelope noise that may be induced in high gain audio circuits of a wireless handset device.

Mat ikram [9] Yusuf et.al analyzed two type of noise cancellation algorithms i.e. least mean square and recursive least mean square algorithm and tries to outline the strength and their weakness. The semi hardware approaches allow to determine the effectiveness in these two algorithms in handling real life situations.

IV. RESULT AND DISCUSSIONS

This section of paper shows the result and related figures and histogram charts adaptive cancellation using wiener filter.

Adaptive Noise Canceller O/P



V. EFFECT OF UNCORRELATED NOISE IN PRIMARY AND REFERENCE INPUTS

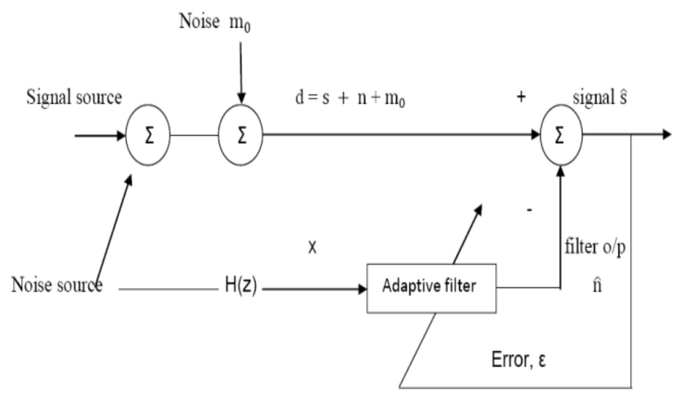


Fig2. ANC with uncorrelated noise m_0 in primary input

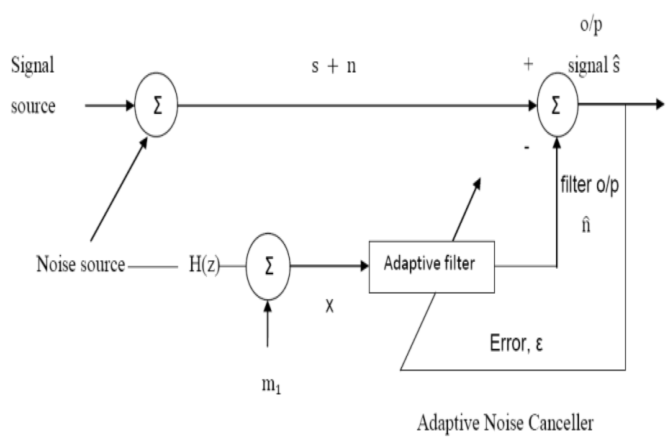
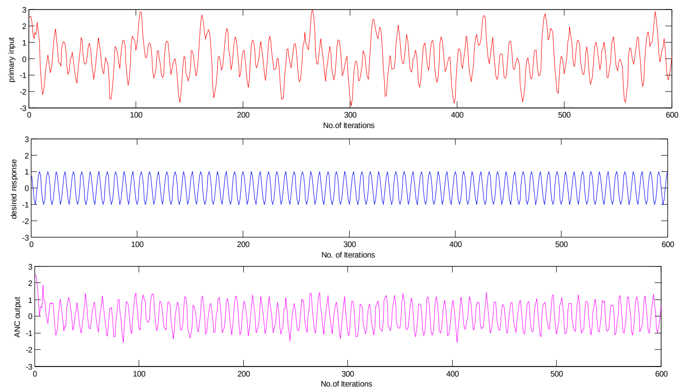


Fig.3.ANC with uncorrelated noise in reference input

ANC is capable of removing only that noise which is correlated with the reference input. Presence of uncorrelated noises in both primary and reference inputs degrades the performance of the ANC. Thus it is important to study the effect of these uncorrelated noises.

The figure shows a single channel adaptive noise canceller with an uncorrelated noise mo present in the primary input. The primary input thus consists of a signal and two noises mo and n. The reference input consists of n* h(j), where h(j) is the impulse response of the channel whose transfer function is H(z). The noises n and n* h(j) have a common origin and hence are correlated with each other but are uncorrelated with s. The desired response d is thus s + mo + n.



VI. CONCLUSION:

Adaptive Noise Cancellation is an alternative way of cancelling noise present in a corrupted signal. The principal advantage of the method is its adaptive capability is its low output noise and its low signal distortion. The adaptive capability allows the processing of inputs whose properties are unknown and in some cases non-stationary. Output noise and signal distortion are generally lower than can be achieved with the conventional optimal filters configurations.

REFERENCE

(1) B.Widrow, "*Ad*aptive Noise Cancelling: Principles and *Applic*ation", Proceedings IEEE, vol.63, pp. 1692-1716, 1975.

(2) Simon haykin, Adaptive Filter theory, prentice hall 11 edition.

(3) B. Widrow and S.D. Stearns, Adaptive Signal Processing , Prentice Hall, Inc. Englewood Cliffs, N.J. 1985.

(4) John R.Glover,jr.,"Adaptive noise cancelling Applied to sinusoidal interference," IEEE trans. ASSP.vol ASSP-25 No.6 pp.484-494,DEC.1997.

(5) J.E.Greenberge, "Modified LMS algorithms for speech processing with an adaptive noise canceller", IEEE Transaction, pp. 338-351, 1998.

(6) Wu Xin, Jeffrey S.Fu, "Sidelobe Suppression Using *Ad*aptive filtering Techniques", IEEE Transactions, pp788-791, 2001.

(7) Kuthluyil Do Gancay and O guz Tanrikulu "*Ad*aptive Filtering Algorithms with selective *p*artial Updates" IEEE Transactions, pp 762-769, 2001.

(8) Leeds S David "*Ad*aptive Noise Cancellation of Coupled Transmitter Burst noise in Speech Signal for Wireless Handset", IEEE Transaction, pp 3924- 3927, 2002.

(9) Abdull*ah* Halim, Yusof Mat Ikram, Shah Rizam Mohd Baki "*Ad*aptive Noise Cancellation: *A Pr*actical study of Least Mean Square over Recursive Least Mean Square Algorithm*", IEEE Tr*ansactions, 448-452, 2002.

(10) M. S. E. Abadi, A. Mahloji Far, M. B. Menhaj, S. A. Hadei "A Fast Affine Projection Algorithm Based On Matching Pursuit with Partial Parameters Adjustment," Amirkabir Journal of Science and Technology. vol. 18. no. 67-A, 2008.

(11) Bai Lin Qinye Yin, "*A* Modified *NLMS* Algorithm *for Ad*aptive Noise Cancellation", *IEEE Tr*ansactions, pp 3726-3729, 2010.

(12) Sanjeev Kumar Dhull, Sandeep K. Arya, and O.P.Sahu, "Performance Comparison of Adaptive Algorithms for Adaptive line Enhancer", IJCSI International Journal of Computer Science Issues , vol. 8, Issue 3, No. 2, May, 2011.

