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Design Method Based on Swarm Algorithm for Digital Adaptive Filters

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ABSTRACT This research article introduces the use of particle swarm optimization techniques in adaptive structures. The working of Particle swarm optimization is similar to Genetic algorithm (GA). Particle swarm optimization (PSO) works by having population (called a Swarm) of a candidate solutions (called particles).In this article proposed a modified method by varying step-size and Evolutionary Computation method for finding optimum value and increasing the speed of convergence.

Keywords: PSO, G.A., IIR and EC.

INTRODUCTION

In digitaltransmission linesthere is an improper communication between receiver and transmitter due to presence of Inter Symbol Interference (ISI). There are number of methods to eliminate ISI such as FIR, IIR and LMS filters. The FIR, IIR and LMS filters are simple and reliable to adjust according to environment changes. Due to its several advantages, filters are found in many applications in digital transmission system. The popularity stems from its relatively low computational complexity, good numerical stability, simple structure and ease of implementation in terms of hardware. LMS algorithm can speed up and reduce Steady state MSE at considerable height, they failed to analyse the optimality of variable step size LMS. The rate at which the coefficients approach their optimum values is called the speed of convergence. From the simulation results shows that the speed of convergence and MSE can be controlled effectively.

CRITICAL REVIEW OF LITERATURE

In reference [1-2] a simplified method is used to find an optimal step-size and to improve the speed of convergence for more number of coefficients. In the earlier paper presented two typical methods for analysing LMS algorithm [3-4]. The very first one is to make the system stable through which stability have analysed. The second one is speed of convergence and and MSE are analysed by approximate method [5] and [6]. That one can at least guarantee stability (MS bounded weights) rigorously. Reference [7 -8] shows performance of two methods of Variable step size of NLMS. Reference [9-10] shows the smoothing coefficients have presented. With the Simulation results they have illustrated that the earlier algorithms have improvement in convergence rate and lower misadjustment error.

SPEED OF CONVERGENCE

The rate at which the coefficients approach their optimum values is called the speed of convergence. The speed of convergence and MSE bothare dependent on step size and filter length, thus have made together several qualitative work. The speed of convergence depends on the step size that is it should satisfy the condition of one half of the maximum value. The proper optimum value can be obtained by choosing different input signals and there out put analysis carefully.

CHOSEN FOR STEP SIZE

We have seen that the speed of convergence increases as the step size increases, up to values that are roughly within a factor of 1/2 of the step size stability limits. Thus, if fast convergence is desired, one should choose a large step size according to the limits. However, also observe that the misadjustment increases as the step size is increased. Therefore, if highly accurate estimates of the filter coefficients are desired, a small step size should be chosen. This classical trade-off in convergence speed vs. the level of error in steady state, dominates the issue of step size selection in many estimation schemes. The point to switch to a smaller step size is roughly when the excess MSE becomes a small fraction (approximately 1/10th) of the minimum MSE of the filter.

SIMULATION

The performance and analysis of EVSSLMS simulation results shows as follows. In this article taken eleven coefficients with 300 samples as a input to the channel. EVSSLMS takes randomly and distributes uniformly as shown in Fig (1). The Gaussian noise having zero mean and standard deviation 0.01 is added to input signals that as shown in Fig (2). The channel characteristics are [0.05 -0.063 0.088 -0.126 -0.25 0.9047 0.25 0 0.126 0.038 0.088].. It can be seen that both algorithms are capable of suppressing the interference not completely but VSSLMS did it effectively without any interference at the output. And the MSE plot for 20 populations with Gaussian noise of 0.44 and the effect of different step size of μ is as shown in fig. (7) to (10)

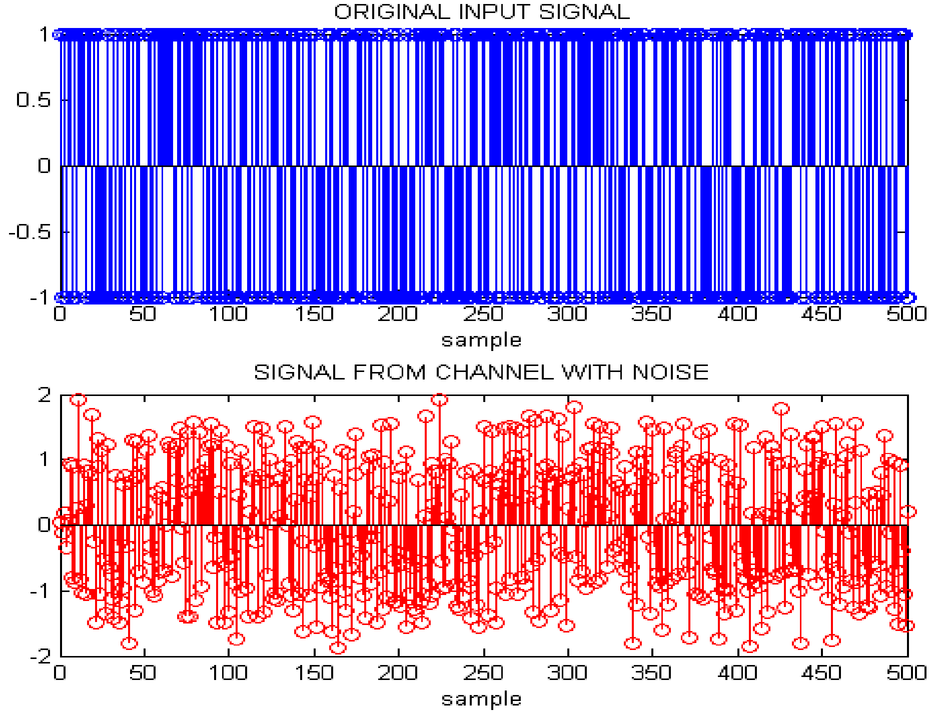

Fig 1.Gaussian noise having zero mean and 0.01 standard deviation

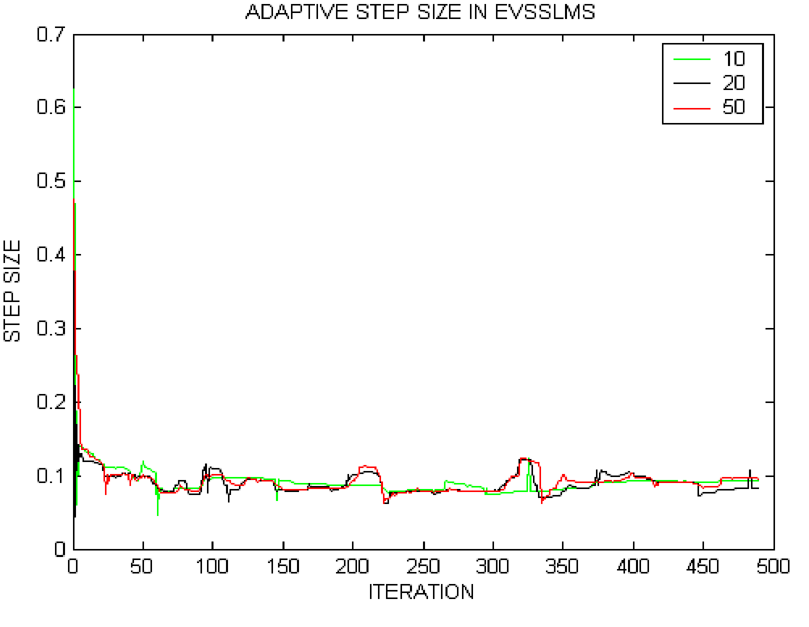

Fig. 2 Channel characteristics

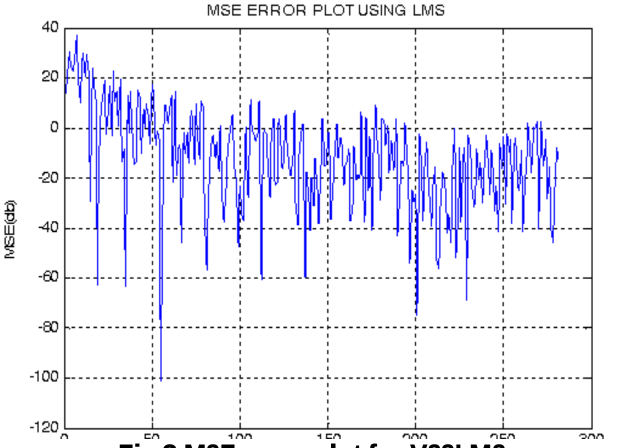

Fig.3.MSE error plot for VSSLMS

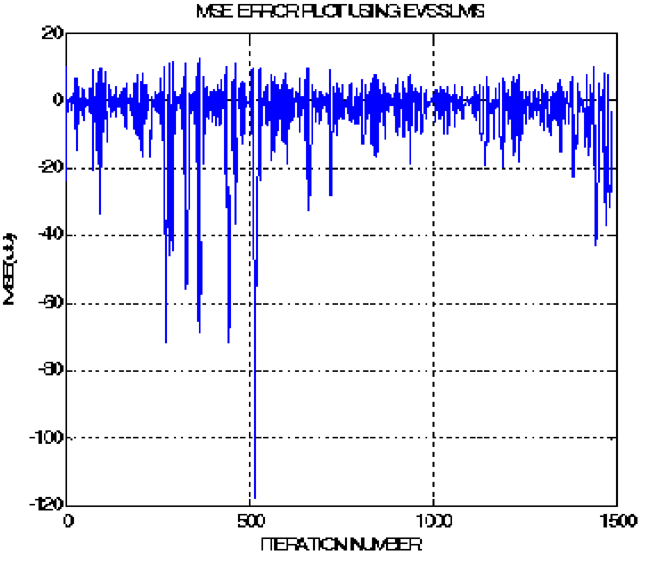

Fig.4.MSE error plot for VSSLMS for step size 0.089

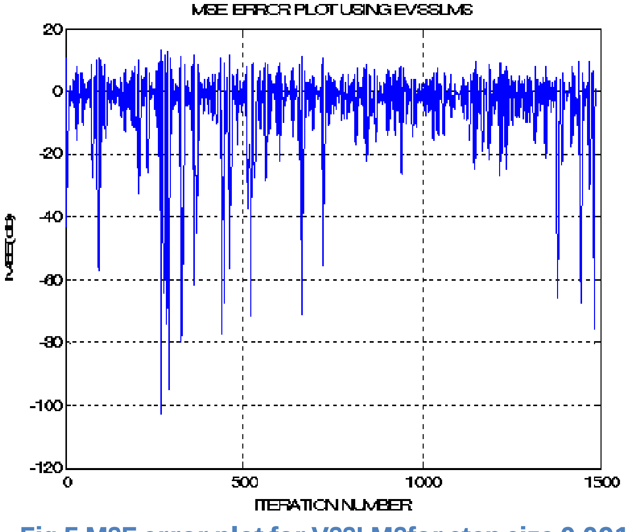

Fig.5.MSE error plot for VSSLMSfor step size 0.091

CONCLUSION

In this paper solved the problem of obtaining the optimum value and speed of convergence by choosing proper variable step size. Presented method is reliable and does not require the statistical characteristics of input signal as in the case of other existing solutions. Very good convergence and tracking capability can be achieved automatically by presented method. Performance of proposed EVSSLMS also checked with different population size and it has shown that with less population performance is also equally well and in result higher speed of solution.

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I always try to turn every disaster into an opportunity.
~ John D. Rockefeller