A SIMPLE ECHO ATTENUATION IN SIGNALS

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Abstract: A simple yet powerful procedure for an echo attenuation in signals is introduced. The presented method involves no external reference signal. It is based on comb FIR filtering. To the advantages of the described method belong the simplicity and performance which are beneficial in real time implementations. For illustration, a simulation of the procedure is included. The efficiency of the presented method is demonstrated by a real time implementation on a digital signal processor.

Key words: *echo attenuation, single-channel, autocorrelation, comb filter, real-time implementation, digital signal processor*

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1. Introduction

An echo occurs in a signal, if, for some reason, the delayed and attenuated replica of the signal is added to the signal itself. This may be caused e.g. by a multi-path propagation, due to some unwanted feedback etc. Closely related to the echo is a reverberation which is for the lag less than 100ms, otherwise it is an echo. The echo attenuation is an important task in the signal processing in numerous systems. There are various applications of an echo attenuation including industrial, measuring, seismic applications, system engineering etc. We are focused here upon an echo attenuation in one-dimensional signals regardless of their origin. The signal is usually, but not necessarily, a function of a time argument. In contrast to a two-channel echo attenuation, where one of the channels is the echo-disturbed signal and the second one is a reference signal, we assume here a single channel echo attenuation. In the single-channel scenario, no external reference signal is available. A good overview in the single-channel echo attenuation can be found in [3,9,12]. Many adaptive methods use a finite impulse response (FIR) filter to estimate and/or cancel an echo. Numerous papers present a gradient based adaptive least mean squares (LMS) FIR filtering, see e.g. [1,5,6]. A common feature to all of these methods is an adaptive filtering using LMS and/or their more elaborated

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