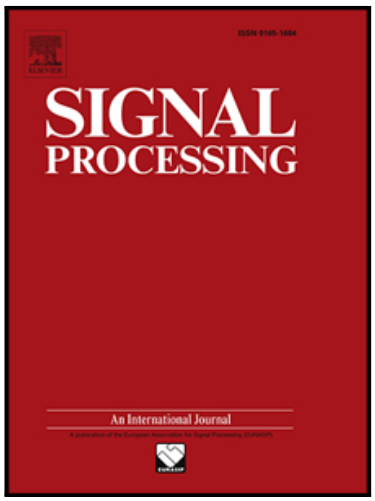

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Juan Marcos Ramirez, Jose Luis Paredes

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Recursive Myriad-Mean Filters: Adaptive Algorithms and Applications

Juan Marcos Ramirez, Jose Luis Paredes

Department of Electrical Engineering, Universidad de Los Andes, Mérida, 5101, Venezuela

Abstract

In this paper, a new class of recursive hybrid filtering structures is proposed for impulsive noise removal; the so-called recursive myriad-mean (RMyM) filters. More precisely, the output of the RMyM filter can be thought of as the sum of two independent weighted M-filters: the nonlinear weighted myriad acting on a subset of input samples and the linear weighted mean acting on a subset of filter's previous outputs. The uncoupled structure of the proposed filters takes into account the benefits of both weighted M-estimators: the robustness against impulsive noise of the myriad operator and the desired spectral response induced by the linear feedback. Least mean absolute (LMA) based adaptive algorithms are developed for designing these filtering structures under the equation error formulation framework. The results of extensive simulations are shown to evaluate both the behavior of the adaptive algorithms as well as the performance of the proposed recursive filters against impulsive noise. Additionally, taking into account the uncoupled structure of the proposed recursive filters, a decision feedback equalizer (DFE) based on the RMyM filter is proposed, where its performance is compared to those yielded by various conventional DFE structures, under different conditions of impulsive noise.

Keywords: Adaptive algorithm, decision feedback equalizer, equation error formulation, hybrid nonlinear filters, recursive filters.

1. Introduction

Recursive filters are feedback structures that consider in the estimation of the filter's current output a subset of previously computed outputs and a subset of input samples. In general, the performance of a recursive filter is notably better than that yielded by its non-recursive counterpart for the same number of filter coefficients. Indeed, a desired frequency-selective filtering operation can be more accurately obtained by using a recursive structure with much fewer filter