Enhancing the FIR Filter Design Using Neural Networks

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Abstract

The Finite Impulse Response (FIR) filter is one of the most important components in digital communications. Therefore, any enhancement of the FIR filter design will improve the efficiency of digital communications. There are several methods proposed to design or improve FIR filters. Involving Artificial Neural Network (ANN) in the FIR designing process is a modern technique that benefits from the high flexibility and non-linearity properties of the ANN. Many works have been proposed in this field, but most of them use random initial values to train neural networks, often producing results with unpredictable quality (weak and not optimal). On the other hand, other researches propose methods for modifying the transfer function of the FIR filter with the aim of enhancing the method, also leading to unsatisfied results in general cases. In this presentation, we propose a novel solution to overcome the limitations of previous works by applying a modified training methods. The proposed method considers the ideal FIR filter as a target value, whereas using a pre-existing (window) methods to obtain the initial value and then use a modified back propagation algorithm (error value modification) to train the neural network. The modification in the error value gives the ability for increasing the stop-band ripple or decreasing the pass-band ripple separately, depending on the desired FIR filter.

Keywords: FIR, Kaiser window, Firls window, Rectangular window, Remez exchange, ANN, Back propagation

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