

Design of IIR Filters from Wavelets: A Comparative Study

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Digital filters being the core of digital signal processing systems are categorized into Finite Impulse Response (FIR) filter and Infinite Impulse Response (IIR) filter. Research in this domain shows that both types of digital filters are significant. Digital FIR filters can be designed directly from the required specifications, while digital IIR filters are popularly designed by applying the frequency transformation on the corresponding analog prototype filter. Literature shows the use of wavelets for digital signal processing. The Daubechies wavelets may be recognized as FIR filters with low-pass and high-pass cut-off frequency of $\pi/2$, respectively. The paper attempts to apply digital frequency transformation to meet the desired cut-off frequency to the wavelet coefficients, and in the process, the FIR filter now becomes an IIR filter. The paper compares the response of the IIR filters designed using wavelets with a corresponding IIR filter designed using bilinear transform and the impulse invariant transform of analog Butterworth filters. It is observed that the frequency responses of the IIR filter designed using wavelets and designed using the bilinear transform are comparable. Hence, we have an alternate and simpler method of designing the IIR filters to meet the given specifications.

Keywords: Bilinear transformation, Butterworth filter, Digital filters, Finite Impulse Response (FIR) filters, Infinite Impulse Response (IIR) filters, Impulse invariant method, Wavelets

Introduction

Digital Finite Impulse Response (FIR) filters or the all-zero filters are the most preferred signal processing applications as they have the linear phase characteristics and are always stable. Infinite Impulse Response (IIR) filters derived from the analog filters do not exhibit linear phase characteristic and can become unstable at higher orders. IIR filters are best used at lower orders and have high computational efficiency. IIR filters work on the present and the past input and output values and are also called the recursive filters. They

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