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FIR Filter Design Technique to Mitigate Gibb's Phenomenon

Niyan Marchon and Gourish Naik

Abstract A unique methodology employing a linear phase finite impulse response (FIR) low pass filter (LPF) was proposed with an attempt to mitigate passband and stopband ripples due to Gibb's phenomenon. The three regions of the filter response in the frequency domain are approximated using trigonometric functions. The proposed filter model achieved a sharp transition of 2π, fairly flat passband and a stopband attenuation of 40 dB. Our algorithm suppressed the oscillations near the edge of the transition region as well as in the passband region, reducing the Gibb's phenomenon from the conventional passband ripples from 18% to as low as 2%. Thus a three-fold satisfactory performance was achieved in all the three bands namely passband, transition and stopband. Our proposed linear phase FIR LPF was effectively used to filter out power line interference and higher unwanted frequencies from the real time electroencephalogram signals.

Keywords Finite impulse response · Linear phase · Low pass filter · Gibb's phenomenon · Electroencephalogram

1 Introduction

To design a finite impulse response (FIR) filter we can approximate the frequency response H (ω) of filter by calculating its impulse response h (n) [1].

$$H(\omega) = \sum_{n=-\infty}^{\infty} h(n)\, e^{-j\omega n} \tag{1}$$

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