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Wavelet packets and their vanishing moments

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Abstract. Sufficient condition for $\widehat{\omega}_{2n+1}(\xi)$ and $m_0(\xi)$ and their first $q-1$ derivatives to vanish respectively at $\xi = 0$ and $\xi = \pi$ has been obtained. A relationship between higher moments of ω_{2n} and ω_{2n+1} for wavelet packets associated with Haar wavelet has been given. Some results for Fourier transform of Hartley-like wavelet packets has been incurred and finally, sufficient conditions for higher vanishing moments of Hartley-like wavelet packets has been procured.

1. Introduction

In 1984, the combined effort of Grossmann and Morlet [5] directed to a complete mathematical study of the continuous wavelet transforms and their various applications. The wavelet theory has provided a new method for decomposing a function or a signal. In 1989, Mallat [10] and Meyer [13] presented the theory of multiresolution analysis. In 1996, Hernández and Weiss [6] studied higher vanishing moments of wavelets. Later in 2015, Khanna, Kumar and Kaushik [7, 8] studied vanishing moments of Hilbert transform of wavelets and give certain results to approximate the functions in $L^2(\mathbb{R})$. To fix the poor frequency localization of high frequency wavelet bases, its significant generalization was introduced by Coifman *et al*. [2] and thereby provide more adequate decomposition containing stationary and transient components. The wavelet packet method is a generalization of wavelet decomposition that offers a richer signal analysis. The wavelet packets can be used for numerous expansions of a given signal. Recently in 2016, Khanna, Kumar and Kaushik [9] introduced a notion of Hilbert transform of wavelet packets and Hartley-like wavelet packets. For various details related to wavelet packets, one may refer to [2, 6].

This paper deals with the study of wavelet packets. First, we give a sufficient condition under which $\widehat{\omega}_{2n+1}(\xi)$ and low pass filter $m_0(\xi)$ and their first $q-1$ derivatives vanishes at $\xi = 0$ and $\xi = \pi$ respectively. This is followed by a relationship between the q^{th}

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