A Variation on Uncertainty Principle and Logarithmic Uncertainty Principle for Continuous Quaternion Wavelet Transforms

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Abstract

The continuous quaternion wavelet transform (CQWT) is a generalization of the classical continuous wavelet transform within the context of quaternion algebra. First of all, we show that the directional quaternion Fourier transform (QFT) uncertainty principle can be obtained using the component-wise QFT uncertainty principle. Based on this method, the directional QFT uncertainty principle using representation of polar coordinate form is easily derived. We derive a variation on uncertainty principle related to the QFT. We state that the CQWT of a quaternion function can be written in terms of the QFT and obtain a variation on uncertainty principle related to the CQWT. Finally, we apply the extended uncertainty principles and properties of the CQWT to establish logarithmic uncertainty principles related to generalized transform.

Keywords: quaternion Fourier transform, uncertainty principle