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FRACTIONAL WIGNER DISTRIBUTION AND AMBIGUITY FUNCTIONS

Veli B. Shakhmurov [1], **Ahmed I. Zayed** [2]

This article is dedicated to Professor Paul Butzer, on his 75th birthday

Abstract

The Wigner distribution function is a time-frequency representation of a signal. In this work we introduce a class of fractional (weighted) Wigner distributions (FWD) using the kernel of the fractional Fourier transform (FFT) as a modulation factor. The fractional modulation depends on an angular parameter α and can be interpreted as a rotation by an angle α in the time-frequency plane. We also introduce a fractional ambiguity function and fractional time-frequency shifts. In addition, an uncertainty principle for the fractional Fourier transform is also derived. These results improve and generalize some of the previous time-frequency distributions derived in the literature.

Mathematics Subject Classification: Primary: 42A38, 44A30; Secondary: 94A14

Key Words and Phrases: fractional Fourier transform, fractional Wigner distribution, fractional ambiguity function, fractional modulation and time-frequency shifts