

Q-Ateb-functions and their properties

Ivanna Dronyuk

Abstract: Ateb-functions as inversion of Beta-functions are generalization of trigonometric functions. Ateb-functions can be expanded to all areas where there are the usual trigonometric functions. We constructed Ateb-transform as a special type of Fourier transform. Using the theory of generalized shift operators (GSO) the algebra under the Hilbert functional space was constructed. Algebra contains "addition" and "multiplication" operations. The addition is the usual addition of functions (correctness follows from the additivity of the addition), and multiplication is a convolution. As the periodic Ateb-functions are orthonormal, we can build a decomposition in a generalized Fourier series and can build for them a generalized harmonic analysis by analogy. We constructed hypergroup using GSO for Ateb - transforms and the corresponding convolution, completing within hypergroup algebra apparatus spectral and time analysis of functional spaces with the basis of Ateb-functions. The q-analog of Ateb-sine (q-Ateb-sine) and q-analog Ateb-cosine (q-Ateb-cosine) are defined as inversion of incomplete q-Beta-function. The properties of these functions are considered. The first interesting result of this investigation is that the constructed functions satisfy q-analog of ordinary differential equation system that ordinal Ateb-functions satisfy. The proof is given by a direct differentiation. The second main result of this investigation is that the main trigonometric identity are proven. The proof is based on q-hypergeometric function series.

¹⁾ Ivanna Dronyuk, Associate Professor: Lviv Polytechnic National University, Bandery 12, 79013 Lviv, Ukraine (UA), ivanna.m.droniuk@lpnu.ua.