MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

Түркі әлемі математиктерінің
VII Дүниежүзілік Конгресі
(TWMS Congress-2023)

БАЯНДАМАЛАРЫНЫҢ ТЕЗИСТЕРІ

ABSTRACTS

of the VII World Congress of Turkic
World Mathematicians
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тюркского мира
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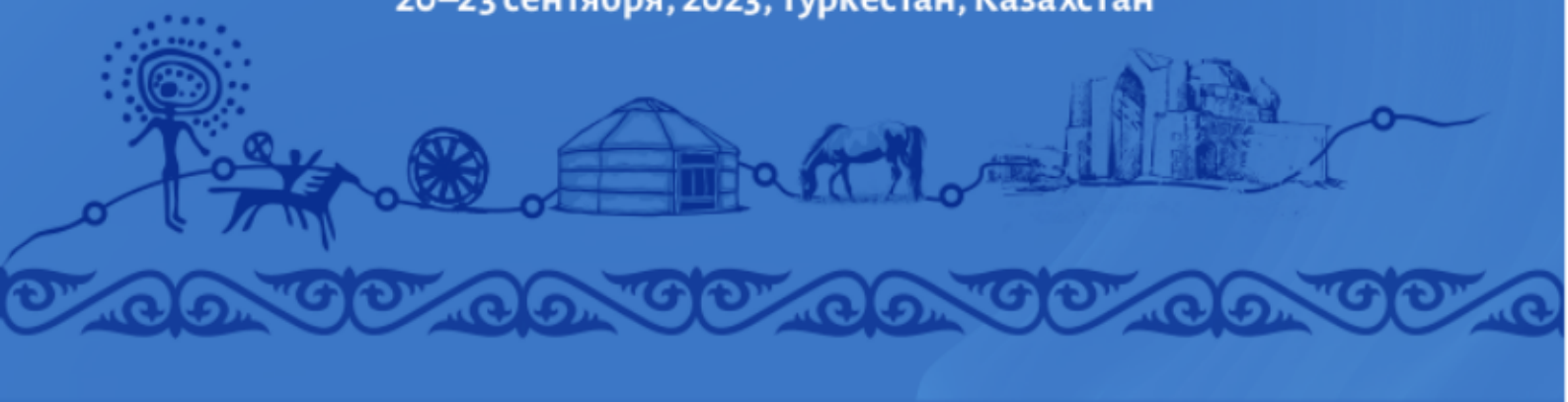
20–23 қыркүйек, 2023, Түркістан, Қазақстан
September 20–23, 2023, Turkestan, Kazakhstan
20–23 сентября, 2023, Туркестан, Казахстан



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ON OPTIMAL QUADRATURE FORMULAS FOR APPROXIMATION OF FOURIER INTEGRALS AND THEIR APPLICATIONS TO CT IMAGE RECONSTRUCTION

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This paper is devoted to the construction of optimal quadrature formulas in the Hilbert space $\widetilde{W}_2^{(m,m-1)}$ of complex-valued, periodic functions for the numerical calculation of the integral $\int_0^1 e^{2\pi i\omega x}\varphi(x)dx$ for $\omega \in \mathbb{Z}$. In the cases $m = 1$ and $m = 2$, the exponentially weighted integrals of some functions at the values of some N and ω are approximated using the constructed optimal quadrature formulas, and it is shown in numerical results that the orders of convergence of this formulas are $O\left(\frac{1}{N+|\omega|}\right)$ and $O\left(\left(\frac{1}{N+|\omega|}\right)^2\right)$, respectively. Also, in the space $\widetilde{W}_2^{(m,m-1)}$, the sharp upper bound of the error for the optimal quadrature formulas is obtained, and it is shown analytically that the order of convergence of the optimal quadrature formula is $O\left(\left(\frac{1}{N+|\omega|}\right)^m\right)$. Furthermore, in the case $\omega \in \mathbb{R}$, effective quadrature formulas for the approximate calculation of Fourier integrals are obtained and they used in the reconstruction of CT images.

Keywords: Strongly oscillatory integrals, optimal quadrature formulas, Hilbert space, periodic functions.

AMS Subject Classification: 65D30, 65D32

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[1] A.R. Hayotov and U.N. Khayriev, Construction of an optimal quadrature formula in the Hilbert space of periodic functions. *Lobachevskii Journal of Mathematics*. Vol. 43, no. 11, 2022, pp. 119–128. DOI: 10.1134/S199508022214013X.

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