

Nechuiviter O.P., Ivanov V.V.

NEW INFORMATION OPERATORS IN PROBLEMS OF NUMERICAL INTEGRATION OF MANY VARIABLES

Educational and Research Institute "UEPA" of V.N. Karazin Kharkiv National University

Due to the rapid development and implementation of the latest information technologies in many fields of science and technology, significant changes have occurred. In particular, new mathematical theories have appeared, which can be effectively used in the construction and improvement of existing mathematical models of various phenomena and objects. Such theories include the theory of new information operators [1-3].

The use of new information operators in digital signal and image processing has led to the emergence of the theory of the calculation of integrals from the high-oscillating functions of many variables at different types of data [4-7]. This theory, allows us to approximate the integrals from the fast-oscillating functions of many variables in the case when the values of the non-oscillating multiplier of the sub-integral function are set not only at points, but also the values of the function on lines and planes.

In the above studies, less attention is paid to the approximate calculation of conventional double or triple integrals at different types of information about the integral function. The problem of numerical integration in itself is very important, therefore, to offer new effective cubic formulas is on time.

In the works [3], the cubature formulas of approximate calculation of the triple integral are presented in the case when the information about the function was given the corresponding traces on mutually perpendicular planes and lines. Cubature formulas were based on the use of interflatation operator.

The purpose of this study is to represent the cubature formulas of the approximate calculation of triple integrals, which in their construction will be used by the interphlet operator, the interlination operator, built on the basis of the interflatation operator, and the interlineation operator, built on the basis of interflatation with auxiliary functions in the form of piecewise-constant splines. It is necessary to obtain estimates of approximation error for proposed cubature formulas on different classes. Test the proposed cubature formulas, show them to be effective in terms of the amount of input information and identify the potential capabilities of the proposed formulas.

References:

1. Sergienko I.V., Zadiraka V.K., Lytvyn O.M. Elements of the General Theory of Optimal Algorithms. Springer, 2021.
2. O. P. Nechuiviter, Application of the theory of new information operators in conducting research in the field of information technologies // Information Technologies and Learning Tools. – 2021. – No. 2 (82), pp. 282–296.
3. O. P. Nechuiviter, O. V. Iarmosh, K. H. Kovalchuk, Numerical calculation of multidimensional integrals depended on input information about the function in mathematical modelling of technical and economic processes / IOP Conf. Series: Materials Science and Engineering. International Conference on Technics, Technologies and Education 2020 (ICTTE 2020) 4th-6th November 2020, Yambol, Bulgaria, 2021. – Vol. 1031 012059.
4. Lytvyn O. M., O. P. Nechuiviter 3D Fourier Coefficients on the Class of Differentiable Functions and Spline Interflatation // Journal of Automation and Information Science. – 2012. – Vol. 44, № 3. – P. 45–56.
5. Lytvyn O. M., Nechuiviter O.P. Approximate Calculation of Triple Integrals of Rapidly Oscillating Functions with the Use of Lagrange Polynomial Interflatation // Cybernetics and Systems Analysis. – 2014. – Vol. 50, № 3. – P. 410–418.
6. O. P. Nechuiviter, Cubature formula for approximate calculation integral of highly oscillating function of tree variables (irregular case) // Radio Electronics, Computer Science, Control. – 2020. – № 4. – pp. 65–73.
7. Oleg M. Lytvyn, Olesia Nechuiviter, Yulia Pershyna, Vitaliy Mezhuyev, Input Information in the Approximate Calculation of Two-Dimensional Integral from Highly Oscillating Functions (Irregular Case) / Recent Developments in Data Science and Intelligent Analysis of Information. ICDSIAI 2018. Advances in Intelligent Systems and Computing, vol 836. Springer, Cham. – 2018. – pp. 365-373.