PhD thesis title: *Computational complexity of Monte Carlo algorithms for multidimensional integrals and integral equations*

Code of speciality: *01.01.09 Computational Mathematics*

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The goal of the current PhD thesis is development of Monte Carlo algorithms with a reduced probability error for multidimensional integrals and integral equations and study of computational complexity of these algorithms.

An adaptive Monte Carlo algorithm for multidimensional integration has been developed. It has a priority over the plain Monte Carlo algorithm according to the estimated relative error for a fixed number of samples.

An important separation algorithm for solving integral equations has been developed based on the important separation method for integrals. Conditions for applying the method have been studied and error analysis has been provided.

A class of grid Monte Carlo algorithms for solving Fredholm integral equations of the second kind has been studied on the assumption that the corresponding Neamann series for the obtained system of linear algebraic equations after approximation does not converge or converges slowly. A specific preconditioning technique has been applied to accelerate convergence - analytical continuation of Neumann series by substituting of spectral parameter. The advantage of this technique is that the computational complexity of the developed Monte Carlo algorithm does not increase essentially.

An estimate of the computational complexity of grid Monte Carlo algorithm for a class of integral equations has been obtained. It has been compared with the corresponding estimate of grid-free Monte Carlo algorithm. The conditions under which the class of grid Monte Carlo algorithms is more efficient are given.

A new Monte Carlo algorithm with a reduced variance has been developed to solve the Barker-Ferry equation that is used as a quantum-kinetic model of electron-phonon interaction in homogeneous semiconductors.

A systematic procedure for providing sensitivity analysis of a large-scale mathematical model describing remote transport of air pollutants has been developed. Most of the results can be applied to other large-scale mathematical models.