ABSTRACT

Dissertation contains 72 pages, 2 applications, 17 figures, 5 tables and 17 references.

Topic Relevance. Cell - is a basic structural and functional unit of all living organisms, the elementary biological system underlying the structure and evolution of organisms, cells are carried through all the functions of living beings.

The study of biological processes within the cell is impossible without modeling these processes and phenomena. In particular, interesting is the matter of changing the concentration and properties of the active substances during these processes.

The solution greatly complicated by the fact that the usual fluctuations in these concentrations is a random variable, and can be estimated quite roughly. It is therefore extremely urgent task is the development of mathematical and software for the simulation of biological processes using stochastic differential equations and solving these equations.

Thesis connection to scientific programs, plans, and topics. The thesis was carried out according to the plan of research department of Applied Mathematics National Technical University of Ukraine "Kyiv Polytechnic Institute".

Research goal and objectives. The goal of this thesis is to reduce effort and improve research in biology with the help of building approximated models of biological processes of cells and their solutions, such as change of concentration of active substances by solving stochastic differential equations.

To achieve the above stated goal were solved the following problems:

- to analyze existing models of cell biological processes, such as change of the concentration of active substances and analysis methods for solving stochastic differential equations;
- to develop a mathematical model of cell biological processes, such as change of the concentration of active substances;
- to develop a software implementation built approximated model biological processes and gain its solutions via developed software.

Object of research is biological processes of cells.

Subject of research is to develop and solve models for cell biological processes, such as change of the concentration of active substances by solving stochastic differential equations using methods polynomial chaos.

Methods of research.In this paper, using methods of mathematical modeling, solving stochastic differential equations, static display methods.

Scientific contribution

– A mathematical model has been developed based on the use of the Wiener-Askey and Galerkin projection metthods, which allows you to create models of biological processes of cells;

– This mathematical model greatly simplifies the solution of stochastic differential equations and has a great rate calculation compared with the Monte Carlo method;

– New framework was built using Matlab tool and it allows to build a decompossition for the Wiener-Asuka differential first and second order.

Practical value of obtained results. of the results obtained during the work lies in the fact that developed model and the software allows you to reduce the time and improve the research in biology, for example in the researches of gene transcription, which allows a better view of the internal structure of cells at the genetic level, which opens up new possibilities in the treatment of gene mutations and diseases, as well as different mating types of cells.

Approbation of the thesis results. The main provisions and the work presented at the VIII scientific conference of graduate and post-graduate "Applied mathematics and computing 'and MVP-2016 XVII International Scientific Conference SAIT 2016.

Publications. The results of the thesis presented in two scientific papers, including:

– VIII scientific conference of masters and PhD students "Applied mathematics and computing - PMC-2016." Abstracts "Using polynomial chaos for modeling biological processes of a cell ";

– XVII International Scientific Conference SAIT 2016 " Using polynomial chaos for modeling biological processes and chemical reactions of the cell".

Keywords: demography, mortality, life expectancy, mathematical model forecasting.