

<b>Title of project, IRN</b>	<b>AP13268824</b> - Methods for solving boundary value problems for quasi-linear impulsive systems of Fredholm integro-differential equations
<b>Timely implementation</b>	01.05.2022-31.12.2024
<b>Supervisor</b>	Sandugash Mynbayeva, Ph.D., Senior Teacher of the Department of Mathematics
<b>Abstract</b>	<p>Boundary value problems for impulsive systems of Fredholm integro-differential equations often arise in applications and have been investigated by many authors. The presence of a pulse significantly affects the properties of solutions of ordinary differential and integro-differential equations. The fundamental difficulties encountered in the study and solution of boundary value problems for linear and quasi-linear Fredholm integro-differential equations with impulse effects require the development of new constructive methods that allow us to effectively determine the solvability of the problems under consideration and find their solutions. The methods being developed in the project are based on a new approach to the general solution of impulse systems of Fredholm integro-differential equations.</p> <p>In the proposed project, new general solutions will be constructed for impulsive systems of Fredholm integro-differential equations and their properties will be established. Methods for solving boundary value problems for impulsive systems based on the construction and solution of systems of algebraic equations in arbitrary vectors of new general solutions will be developed. Systems of algebraic equations will be constructed using solutions of Cauchy problems for ordinary differential equations.</p> <p>Qualitative research methods are planned in the project. The main attention is paid to the study of the ideas embedded in the author's research concept, the confirmation of the main hypothesis, and the formulation of the results obtained in the form of theorems.</p> <p>The main hypothesis of the project is that numerical algorithms for finding solutions can be developed for boundary value problems of impulsive systems of Fredholm integro-differential equations.</p> <p>The author's research concept is that approximate and numerical methods based on the Dzhumabaev parametrization method will be proposed for the studied boundary value problems of impulsive systems of Fredholm integro-differential equations. When applying the parametrization method, intermediate special Cauchy problems with parameters arise. Substituting the solution of the special Cauchy problem into boundary conditions and continuity conditions, a system of algebraic equations is compiled. Numerical methods are used to solve intermediate problems.</p>
<b>Goal</b>	Establish conditions of solvability of boundary value problems (BVPs) for quasi-linear impulsive systems (ISs) of Fredholm integro-differential equations (FIDEs). Develop approximate and numerical methods for solving BVPs for ISs of FIDEs. Construct effective algorithms for finding solutions to BVPs for ISs of FIDEs and their numerical implementation.
<b>Expected Results</b>	The main results to be obtained within the framework of the project: <ul style="list-style-type: none"> <li>• New general solutions of linear impulse systems of Fredholm integro-differential equations will be constructed.</li> </ul>

	<ul style="list-style-type: none"> <li>• New approximate and numerical methods for solving periodic boundary value problems for pulsed systems of Fredholm integro-differential equations will be developed.</li> <li>• New effective approximate and numerical methods for solving linear boundary value problems for impulse systems of Fredholm integro-differential equations will be developed.</li> <li>• New general solutions of quasi-linear impulse systems of Fredholm integro-differential equations will be constructed.</li> <li>• The conditions of solvability of boundary value problems for quasi-linear impulse systems of Fredholm integro-differential equations will be established.</li> <li>• New approximate and numerical methods for solving boundary value problems for quasi-linear impulse systems of Fredholm integro-differential equations will be developed.</li> <li>• Efficient algorithms for finding solutions to boundary value problems for impulse systems of Fredholm integro-differential equations will be constructed.</li> </ul> <p>Mathematical modeling of real processes often leads to boundary value problems for Fredholm integro-differential equations with impulsive effects. The expected scientific results and approximate methods developed on their basis can be the mathematical basis for qualitative and quantitative analysis of the simulated processes.</p> <p>The scientific results can be used in the study of new classes of boundary value problems for impulsive systems of Fredholm integro-differential equations, used for a comprehensive analysis of the simulated processes of physics, biology, chemistry, economics, etc.</p>
<b>The Research Group</b>	<p><i>Project manager:</i> Mynbayeva Sandugash, Ph.D.,  Hirsch Index = 2, Web of Science Researcher ID: <a href="#">AAK-6134-2020</a>;  Scopus Author ID: <a href="#">57211938645</a>;  ORCID: <a href="http://orcid.org/0000-0001-6266-9357">http://orcid.org/0000-0001-6266-9357</a></p> <p><i>Scientific consultant:</i> Assanova A. T., d.ph.-m.s., Professor, H-index – 11, Web of Science Researcher ID: C-6804-2016;  Scopus Author ID: <a href="#">57201858608</a>;  ORCID: <a href="http://orcid.org/0000-0001-8697-8920">http://orcid.org/0000-0001-8697-8920</a>.</p>
<b>Publications in Scientific Editions</b>	<p>1. Mynbayeva S.T. An algorithm for solving a boundary value problem for impulsive systems of Fredholm integro-differential equations. Abstracts the international conference: dynamical systems, modeling and Mathematical Sciences. Dubai/UAE, September 23-25, 2022. P.45</p>