Project name, IRN	**AP19675358 -** Solutions in the broad sense of systems of partial differential equations with periodic on part of variables and multipoint conditions
Completion date	01.07.2023-31.12.2025
Project supervisor	Imanchiev Askarbek Ermekovich, candidate of physical and mathematical sciences, associate professor
Report	In many mathematical models, especially in theory of "shallow water", flat steady supersonic flow of compressible gas, partial differential equations arise. Classical solutions of nonlinear equations have the property of an unlimited increase in magnitude of derivatives, which is called gradient catastrophe. Meaning of this property is that with arbitrarily smooth initial values, first derivative solutions remain limited, only for finite time. Existence of solution in broad sense does not require smoothness from the input of system partial differential equations. If inputs of system equations have sufficient smoothness and satisfy the additional conditions associated with smoothness, then constructed solution in broad sense also classical solution. In era of rapidly developing computational and computer mechanics, new models and methods for solving problems are created, focused mainly on features of their software implementation. Fundamental difficulties encountered in study of solution in broad sense of systems partial differential equations and use of computer technology require the development of new design methods for numerical and approximate solution that can effectively determine the solvability of edge problems for such systems. Relevance of project is due, on one hand, to importance of practical application of solution in broad sense of systems partial differential equations in mathematical modeling of various oscillatory processes, on other hand, to need to develop design methods that allow building solutions in broad sense periodic on part of variables and multipoint conditions. Project will consider solutions in broad sense of systems partial differential equations with periodic on part of variables and multipoint conditions. Connection to boundary problems is established for ordinary differential equations. Multipoint nonlinear edge problems for first-order differential equations will be solved on basis of algorithms of Dzhumabaev parameterization method, numerical methods and iterative algorithms for finding an approximate solution in broad sense of systems partial differential equations will be proposed. Expected scientific results of project are significant contribution to theory of partial differential equations.
Purpose	Develop design methods of research and construction of solution in broad sense of systems differential equations in partial derivatives of first order with periodic on part variables and multipoint conditions and build approximate and numerical methods for solving edge problems for them.

Expected results	• Parameterization method will be applied to the construction of solution in broad sense of boundary problem for first-order partial derivative system with same main part with periodic on part of variables and multipoint conditions; • Parameterization method will be applied to the construction of solution in broad sense of boundary problem for first-order partial derivative system with an unequal main part with periodic on part of variables and multipoint conditions; • Parameterization method will be applied to the construction of solution in broad sense of boundary problem for systems of first-order partial differential equations from countable set of variables with periodic on part of variables and multipoint conditions; • Conditions of unambiguous solvability in broad sense of boundary problem of systems of the equation in partial derivatives of first order with periodic on part of variables and multipoint conditions will be established; • Approximate methods of finding solution in broad sense of systems of first-order partial differential equations with periodic on part of variables and multipoint conditions and effective algorithms for finding their solutions in the broad sense will be developed; • Numerical methods for finding solution in broad sense for systems of first-order partial differential equations with periodic on part of variables and multipoint conditions will be developed. **Based on the results of the project, the following will be published:** - at least 3 (three) articles and (or) reviews in peer-reviewed scientific publications in the scientific direction of the project, indexed in the Science Citation Index Expanded and included in the 1st (first), 2nd (second) and (or) 3rd (third) quartile by impact factor in the Web of Science database and (or) having a CiteScore percentile in Scopus database of at least 50 (fifty); - at least 1 (one) article or review in a peer-reviewed foreign or domestic publication recommended by the KOKSNVO; - or at least 2 (two) articles and (or) reviews in peer-reviewed scientific publications indexed in the Science Citation Index Expanded and included in the 1st (first) and (or) 2nd (second) quartile by impact factor in the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 65 (sixty-five); - or at least 1 (one) article or review in a peer-reviewed scientific publication indexed in the Science Citation Index Expanded and included in the 1st (first) quartile in the Web of Science database or having a CiteScore percentile in the Scopus database of at least 95 (ninety-five).
Research group	Supervisor – Imanchiev Askarbek Ermekovich, Candidate of Physical and Mathematical Sciences, Associate Professor, Hirsch Index: WoS=4 Scopus=3 Web of Science Researcher ID: AAP-8608-2020 ;

	Scopus Author ID: 57188816026; ORCID Author number: http://orcid.org/0000-0002-1835-2501 . Asanova Anar Turmaganbetkyzy, Ph.D., Professor Indexer WoS=11 Scopus=10 Web of Science Researcher ID: C-6804-2016; Scopus Author ID: 57201858608; Author's ORCID number: http://orcid.org/0000-0001-8697-8920 . Bekbauova Altynshash Upukyzy, Ph.D. Indexer WoS=1 WoS Researcher Identification Number: C – 8444 - 2022, Scopus Author ID: 57435359000 https://orcid.org/0000-0002-5847-9881 . Talipova Meiramgul Zhubatkanovna, Ph.D. Scopus Author ID: 57195809117; Author's ORCID number: https://orcid.org/0000-0001-9728-8378 Kurmangaliev Yergali Kdyrgalievich, Ph.D. Author's number ORCID: https://orcid.org/0000-0002-3583-9215 Zhantleuova Kamila Moldagalikyzy, Master of Technical Sciences Author's ORCID number: https://orcid.org/0000-0001-6071-5356 Tankeeva Aigerim Kievna Doctor, 8D05401 – Mathematics Author's ORCID number: https://orcid.org/0000-0002-3897-5909