Project name, IRN	AP25794325 - Development of approximate methods for solving boundary value problems for Fredholm integro-differential equations with a non-degenerate kernel
Completion date	27.02.2025-31.12.2027
Project supervisor	Tankeyeva Aigerim Kiyevna
Report	Fredholm integro-differential equations are fundamental in many scientific fields, including biology, engineering, physics, chemistry, potential theory, electrostatics, finance, elasticity theory, astronomy, economics and heat and mass transfer. The solution of these equations, unlike ordinary differential equations and Volterra integro-differential equations, does not always exist. Therefore, the development of numerical methods is important for solving these equations and problems. In the proposed project, using the methods of Chebyshev and Legendre polynomials, we obtain approximate solutions of Fredholm integro-differential equations with a non-degenerate kernel and the boundary value problems assigned to them. These methods are effective in solving Fredholm integro-differential equations of the first and second order with a non-degenerate kernel. This is due to the fact that by approximating the kernels of Fredholm integro-differential equations with a non-degenerate kernel, it is reduced to equations with a non-degenerate kernel, then leads to the solution of boundary value problems using the results obtained by the parameterization method.
Purpose	Development of approximate and numerical methods for solving boundary value problems for Fredholm integro-differential equations with a non-degenerate kernel based on Chebyshev and Legendre polynomials.
Expected results	The kernel of the first-order Fredholm integro-differential equation will be approximated by the Chebyshev polynomial. The Chebyshev polynomial method will be applied to the solution of the first-order Fredholm integro-differential equation with a non-degenerate kernel. The Chebyshev series method will be developed for the numerical solution of the first-order Fredholm integro-differential equation with a non-degenerate kernel. The Chebyshev series method will be proposed to solve the boundary value problem for the first-order Fredholm integro-differential equation with a non-degenerate kernel. By the Legendre polynomial, the kernel of the first-order Fredholm integro-differential equation will be approximated. The Legendre polynomial method will be used to solve the first-order Fredholm integro-differential equation with a non-degenerate kernel. The Legendre series method will be developed for the numerical solution of the first-order Fredholm integro-differential equation with a non-degenerate kernel. The Legendre series method will be proposed to solve the boundary value problem for the first-order Fredholm integro-differential equation with a non-degenerate kernel. A numerical solution of the second-order Fredholm integro-

	differential equation with a non-degenerate kernel will be obtained by the Chebyshev series method. The Chebyshev series method will be proposed to solve the boundary value problem for the second-order Fredholm integro-differential equation with a non-degenerate kernel. The numerical solution of the second-order Fredholm integro-differential equation with a non-degenerate kernel will be obtained by the Legendre series method. To solve the boundary value problem for the second-order Fredholm integro-differential equation with a non-degenerate kernel, the Legendre series method will be proposed. Publication of at least 2 (two) articles in journals from the first three quartiles by impact factor in the Web of Science database or with a CiteScore percentile of at least 50 in the Scopus database.
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List of published works	