Solvability of the nonlinear boundary value problem for Fredholm integro-differential equation with impulse effect

Dulat Dzhumabaev[a], *Elmira Bakirova*[b]
[a,b] *Institute of Mathematics and Mathematical Modelling, Kazakhstan*
[b]bakirova1974@mail.ru

Abstract: Consider the nonlinear two-point boundary value problem for Fredholm integro-differential equation with impulse effect

$$\frac{dx}{dt} = f_0(t,x) + \int_0^T f_1(t,s,x(s))ds, \quad t \in (0,T)\backslash\{\theta\}, \quad x \in R^n, \tag{1}$$

$$A_0 \lim_{t\to\theta-0} x(t) + B_0 \lim_{t\to\theta+0} x(t) = d_0, \tag{2}$$

$$A_1 x(0) + B_1 x(T) = d_1. \tag{3}$$

In [1, 2], solvability of problem (1) – (3) was investigated by the parameterization method. Approximation methods for finding its solutions are constructed. The problem of choice of initial approximation to the solution and algorithms for solving are studied.

Algorithms for finding solution to problem (1) – (3) needs solving the special Cauchy problem for integro-differential equations with parameters.

Sufficient conditions for existence of unique solution to the special Cauchy problem and the estimate of difference of its solutions are obtained in [3]. The solvability conditions for the linear boundary value problem with parameter for the Fredholm integro-differential equation with impulse effect is given in [4].

Keywords: integro-differential equation, nonlinear boundary value problem, parameterization method, solvability, impulse effect.

References:

[1] D.S. Dzhumabaev, A method for solving the linear boundary value problem for an integro-differential equation, Computational Mathematics and Mathematical Physics, vol. 50, no. 7, pp. 1150-1161, 2010.

[2] D.S. Dzhumabaev, S.M. Temesheva, A parameterization method for solving nonlinear two-point boundary value problems, Computational Mathematics and Mathematical Physics, vol. 47, no. 1, pp. 37-61, 2007.

[3] E.A.Bakirova, Existence and uniqueness of a solution of the special Cauchy problem for the nonlinear integro-differential equations, Mathematical journal, vol. 11, no. 1 (39), pp. 43-52, 2011.

[4] D.S. Dzhumabaev, E. Bolganisov, A solvability of linear boundary value problem with parameter for impulsive Fredholm integro-differential equations, News of the NAS RK, no. 5(291), pp. 25-30, 2013.