About the strong solvability of mixed problems for first order equations with deviating argument

Amir Shaldanbaev[a], *Salima Shalenova*[b]
[a,b] *M. Auezov South Kazakhstan State University, Kazakhstan,*
[a]shaldanbaev51@mail.ru , [b]salima_shalenova@mail.ru

Abstract: In this paper, we have obtained the criteria for strong solvability of a mixed problem for functional differential equations, by methods of spectral theory of operators.

Statement of the problem.

Let $\Omega \subset R^2$ is a quadrangle bounded by segments: $AB: 0 \le y \le 1$, $x=0$; $BC: 0 \le x \le 1$, $y=1$; $CD: 0 \le y \le 1$, $x=1$; $DA: 0 \le x \le 1$, $y=0$.

The set of functions $u(x,t)$ denoted by $C^{1,1}(\Omega)$, which are continuously differentiable in Ω, by variables x and t. The set of segments explains the boundary of domain Ω [1].

Mixed problem. Finding the solution of equation

$$Lu = iu_x(x,y) + u_y(x,1-y) = f(x,y), \tag{1}$$

which satisfies the boundary conditions

$$u\big|_{y=0} = 0, \tag{2}$$

$$u\big|_{x=0} = \alpha u\big|_{x=1}, \quad |\alpha| = 1, \tag{3}$$

where $f(x,y) \in L^2(\Omega)$.

The idea of the work is very simple. Investigation task corresponds to some linear operator in Hilbert space [2]. Strong solvability of the examined regional task is investigation of a limit convertibility of this operator.

Keywords: continuous spectrum, self-conjugate operator, orthonormal base.

References:

[1] S. Mizohata. The Theory of Partial Differential Equations, Mir, Moscow, 1977.
[2] A.Kolmogorov, S.Fomin. Elements of the theory of functions and functional analysis, Nauka, Moscow, 1968.