Boundary Value Problem for a Third Order Partial Differential Equation

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Abstract. Boundary value problems for third order partial differential equations in a Hilbert space are investigated. The stability estimates for the solution of the boundary value problem is established. To validate the main result, some stability estimates for solutions of the boundary value problems for third order equations are given. Here, the boundary value problem

$$\begin{cases} \frac{d^3u(t)}{dt^3} - Au(t) = f(t),\ 0 < t < 1, \\ u(0) = \varphi,\ u_t(0) = \psi,\ u_{tt}(1) = \xi, \end{cases} \tag{1}$$

for a third order partial differential equation in a Hilbert space H with a self-adjoint positive definite operator A is considered. We are interested in studying the stability of solutions of problem (1).

A function $u(t)$ is a *solution* of problem (1) if the following conditions are satisfied:

i) $u(t)$ is three times continuously differentiable on the interval $(0,1)$ and continuously differentiable on the segment $[0,1]$. The derivatives at the endpoints of the segment are understood as the appropriate unilateral derivatives.

ii) The element $u(t)$ belongs to $D(A)$ for all $t \in [0,1]$, and function $Au(t)$ is continuous on the segment $[0,1]$.

iii) $u(t)$ satisfies the equation and boundary conditions (1).

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