

On a differential game in a retarded distributed system

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We consider the game problem of approach for a distributed system whose dynamics in an abstract form is described by the retarded differential equation in separable Hilbert spaces H, U, V with the initial conditions

$$\frac{d}{dt}y(t) = Ay(t) + By(t-h) + K_1u(t) - K_2v(t), \quad a.e. t \in [0, T], \quad (1)$$

$$y(0) = y_0, \quad y(t) = g(t), \quad a.e. t \in [-h, 0), \quad (2)$$

where a sectorial operator A in H generates an analytic semigroup; B, K_1, K_2 are bounded linear operators from H, U, V , respectively, to H ; the controls $u(t)$ and $v(t)$ of the the pursuer and evader, respectively, are measurable vector functions with values in control domains U_0 and V_0 , which are closed convex bounded sets in U and V , respectively. A solution of problem (1),(2) is understood in the strong sense. The goal of the game in system (1),(2) is to bring the state $y(t)$ to a cylindrical terminal set in a finite time (not exceeding T) in the class of admissible controls of the pursuer for any admissible control of the evader. For using the method of resolving functionals, the solution $y(t)$ is represented in the form that admits the additive entry of the term with initial data and the control unit: $y(t) = W(t)y_0 + \int_{-h}^0 W(t-s-h)Bg(s)ds + \int_0^t W(t-s)[K_1u(s) - K_2v(s)]ds$, where a family $W(t)$ of bounded linear operators in H is constructed by an explicit formula. Applications to distributed systems, whose dynamics is described by partial differential equations with time delay, are considered. In particular, we investigate the differential game for a retarded conflict-controlled heat conduction process with distributed heat sources and leaks.