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On the robustness of the integrable trajectories of the control systems with limited control resources

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The control system described by Urysohn type integral equation is considered where the system is nonlinear with respect to the phase vector and is affine with respect to the control vector. The control functions are chosen from the closed ball of the space $L_q(\Omega;\mathbb{R}^m)$, $q > 1$, with radius r and centered at the origin. The trajectory of the system is defined as p-integrable multivariable function from the space $L_p(\Omega;\mathbb{R}^n)$, $\frac{1}{q}+\frac{1}{p}=1$, satisfying the system's equation almost everywhere. It is shown that the system's trajectories are robust with respect to the fast consumption of the remaining control resource. Applying this result it is proved that every trajectory can be approximated by the trajectory obtained by full consumption of the total control resource.

Key words: nonlinear control system, integral equation, integral constraint, integrable trajectory, robustness.

1. Introduction

The control systems described by integral equations is one of the important chapters of the control systems theory. The integral models undoubtedly have some advantages over differential ones, since the integral models allow to use continuous, and even integrable functions as the system's trajectory. It should be also underlined that the solution concepts for different type of initial and boundary value problems for differential equations can be reduced to solution notions for appropriate integral equations. Note that the theory of the linear integral equations

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