

ON A CLASS OF STRONG MODELS OVER A COUNTABLE SET OF DYNAMICAL PROCESSES OF A FINITE CHARACTER

A.V. Daneyev and V.A. Rusanov

Introduced in [1] and developed in [2]–[5], the concept of a strong (A, B) -model is conjugated with the set-theoretic constructions by Kalman–Mesarovic (see [6], p. 21; [7], p. 54) in application to the problem of realization of a linear continuous finite-dimensional controllable system (see [6], p. 353). In addition, the investigation of the problem of realization of namely a linear continuous system (see [8] for a discrete approach) is conditioned not solely by a possibility to use in full measure rich tools of the linear mathematics, but also by other reasons. First, a theory of modeling of similar systems is necessary for a local study of the problem of realization of nonlinear objects (see [9]). Second, the analytical apparatus of strong (A, B) -models opens a perspective of generalization, in a linear statement, of the classical determined theory of identification (see [3]), in particular, on the base of application of special procedures of logic conclusion (automatic proof of theorems) in processes of construction of differential models of control (see details in [2]).

1. Statement of problem

Let $(X, \|\cdot\|_X)$ be a real finite-dimensional Banach space, $t_0 < t_1$, $T \hat{=} [t_0, t_1]$ a segment on the numerical axis R with the Lebesgue measure μ , and $L_p(T, \mu, X)$, $1 \leq p < \infty$, Banach spaces of equivalence classes (mod μ) of μ -measurable mappings $\psi : T \rightarrow X$, summable by Bochner, with the norm $\|\psi\|_p^X \hat{=} \left(\int_T \|\psi(t)\|_X^p \mu(dt) \right)^{1/p}$. We denote by $H_{p'}$ ($1 \leq p' < \infty$) the space $L_{p'}(T, \mu, R^n) \times L_{p'}(T, \mu, R^m)$ with the norm $\|(\omega_1, \omega_2)\|_{H_{p'}} \hat{=} [(\|\omega_1\|_{p'}^{R^n})^{p'} + (\|\omega_2\|_{p'}^{R^m})^{p'}]^{1/p'}$, $\omega_1 \in L_{p'}(T, \mu, R^n)$, $\omega_2 \in L_{p'}(T, \mu, R^m)$. Finally, let $AC(T, R^n)$ be a linear manifold of all absolutely continuous on T functions with values in R^n and $\Pi \hat{=} AC(T, R^n) \times L_{p'}(T, \mu, R^m)$; in addition, we shall use the notation of the construction of Π without special mentioning that a) the set Π is a subset in $H_{p'}$ (in this position to points from $AC(T, R^n)$ in the construction of Π the corresponding equivalence classes from $L_{p'}(T, \mu, R^n)$ are put and vice versa: if a certain equivalence class from $L_{p'}(T, \mu, R^n)$ contains a point from $AC(T, R^n)$, then such a point is unique); b) the topological structure in Π is the restriction of the metric topology from $H_{p'}$, generated by the norm $\|\cdot\|_{H_{p'}}$.

Let us select a class of linear multidimensional systems described by a vector matrix differential equation of the form

$$\dot{x}(t) = A(t)x(t) + B(t)u(t), \quad t \in T. \quad (1)$$

In doing so, we suppose that $x(\cdot) \in AC(T, R^n)$ is the Caratheodory solution (K -solution), $u(\cdot) \in L_{p'}(T, \mu, R^m)$ is a vector function of control, $A(\cdot) \in L_p(T, \mu, \mathcal{L}(R^n, R^n))$, $B(\cdot) \in L_p(T, \mu, \mathcal{L}(R^m, R^n))$, where $p, p' \in (1, \infty)$ and are connected via the relation $1/p + 1/p' = 1$, $\mathcal{L}(R^m, R^n)$ is a Banach space (with operator norm) of all linear operators acting from R^m to R^n . We shall admit a

Supported by Russian Foundation for Basic Research (project no. 99-01-01279).

©2000 by Allerton Press, Inc.

Authorization to photocopy individual items for internal or personal use, or the internal or personal use of specific clients, is granted by Allerton Press, Inc. for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$50.00 per copy is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923.