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ON THE CONVEXITY OF REACHABLE SETS FOR CERTAIN CONTROL PROBLEMS – AN ERRATUM

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We learnt in the textbook "Optimization of linear systems" by R. F. Gabasov and F. M. Kirillova (Minsk 1973) that the reachable set of a control system described by

$$\dot{x}(t) = A(t)x(t) + b(t, u(t)), \quad u(t) \in U,$$

is convex, even if the control set U is not convex. The convexity of the reachable set of a more general problem is insisted in the paper "On Convexity of Reachable Sets for Nonlinear Control Systems" presented by V. Azhmyakov, D. Flockerzi and J. Raisch, 2007. The controls are assumed to be Lipschitz–functions with Lipschitz–constants $l_u \leq l$ and the right–hand side f of the process equation is assumed to fulfil a Lipschitz–condition. However, the main theorem of this paper dealing with the convexity of the reachable set is false. We will illustrate this by means of two counterexamples.

ON EXACT NULL-CONTROLLABILITY OF DISTRIBUTED SYSTEMS

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Let X, U be Hilbert spaces, and let A be infinitesimal generator of strongly continuous C_0-semigroups $S(t)$ in X [1],[2]. Consider the abstract evolution control equation [2]

$$\dot{x}(t) = Ax(t) + Bu(t), x(0) = x_0, \ \ 0 \leq t < +\infty, \tag{1}$$

where $x(t), \ x_0 \in X, u(t), u_0 \in U, \ B : U \to X$ is a linear possibly unbounded operator, $W = D(A) \subset X \subset V$ are also Hilbert spaces with continuous dense injections and $A : W \to V$ and $B : U \to V$ are bounded operators. The space W is a Hilbert space with respect of graph norm.

Let $x(t, x_0, u(\cdot))$ be a mild solution of equation (1) with initial condition $x(0) = x_0$.

The assumptions on A are listed below.

1. The operators A has purely point spectrums σ with no finite limit points. All eigenvalues of A have finite multiplicities.

2. There exists $T \geq 0$ such that all mild solutions of the equation $\dot{x}(t) = Ax(t)$ are expanded in a series of generalized eigenvectors of the operator A converging uniformly for any $t \in [T_1, T_2], T < T_1 < T_2$.