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ANTI-PERIODIC SOLUTIONS TO SEMILINEAR POLYTOPE INCLUSIONS WITH HILLE-YOSIDA OPERATORS

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Abstract. We consider a class of polytope differential inclusions in Banach space assuming that its linear part is a non-densely defined Hille-Yosida operator. In our problem, $\{S'(t)\}$ is a C_0-semigroup and the multivalued nonlinearity satisfies a regularity condition expressed in terms of the measure of noncompactness. Applying the theory of integrated semigroup and fixed point theory of multivalued map, we prove the existence of an anti-periodic solution. Furthermore, two examples are given to illustrate our result.

Keywords. Anti-periodic solution; Hille-Yosida operator; Measure of noncompactness; Fixed point theory.

AMS (MOS) subject classification: 35B10, 47H10, 47H08.

1 Introduction

Let $(X, \|\cdot\|)$ be a Banach space. In this paper, we are concerned with the existence of solutions for the following problem

$$u'(t) \in Au(t) + F(t, u(t)), \quad t \in \mathbb{R}, \tag{1}$$

$$u(t+T) = -u(t), t \in \mathbb{R}, \tag{2}$$

where u is the state function with values in X, $F(t,u(t)) = \overline{\text{conv}}\{f_1(t,u(t)),\ldots, f_n(t,u(t))\}$, here the $\overline{\text{conv}}$ stands for the closure of the convex hull of a subset in a functional space which will be defined latter; A is a Hille-Yosida operator with the domain $D(A)$ such that $\overline{D(A)} \neq X$ and the part of A in $\overline{D(A)}$ generates a C_0-semigroup $\{S'(t)\}_{t\geq 0}$.

It is known that the differential inclusions like (1) arise from control problems in which control factor is possibly uncertain and chosen in a polytope of feedbacks. The fundamental results on solvability and structure of solution set for differential inclusions can be found in [8, 15, 20]. The methods of the theory of condensing multioperators were applied to prove the existence of a mild solution to a semilinear functional differential inclusion with a nondensely defined Hille-Yosida operator can see in [28].