CONTROLLABILITY AND OBSERVABILITY OF THE SWITCHED SYSTEMS IN BANACH SPACE

Wei Sun[1] and Li Zeng[2] and Yi Zhao[1] and Yu Huang[1]

[1]School of Mathematics and Computational Science, Sun Yat-sen University,
Guangzhou, Guangdong 510275

[2]Department of Applied Mathematics, School of Informatics,
Guang Dong University of Foreign Studies,Guangzhou,510420

Abstract. Many experiment models in some branches of physics and technical science turn out to be switched functional differential systems in Banach Space while reports about the switched system in Banach Space seems few because a much more difficult situation arises from the variation of the space with the endowed norm. In this note the controllability and observability issues for switched linear control systems are extended to Banach Space with bounded operators. Sufficient conditions for controllability, sufficient and necessary condition for observability are established respectively. And the controllability condition is discussed for the infinite delay case. The results are obtained by using the semigroup theory, Arzela-Ascoli theorem and the Schaefer fixed-point theorem.

Keywords. Switched systems, Arzela-Ascoli theorem, controllability, observability, switched sequence.

1　Introduction

During the last decade, there has been increasing interest in the analysis and synthesis of switched systems due to their significance for theoretical development as well as for practical applications (see [1], [3], [10]).

A lot of systems encountered in practice exhibit switching between several subsystems which are dependent on various environmental factors. Therefore, switched systems have numerous applications in control of mechanical systems, air traffic control, chemical processes, robotic manufacturing systems, transportation systems, switched power converters, and many other applications(see [4], [10]). The books [2], [15] contain results on various developments in some of these fields.

Controllability and observability of switched control systems have been studied by a number of papers [11],[18]. Zhendong Sun and Guangming Xie et al. ([5], [6], [7], [9], [16], [17]) investigated the controllability and observability of switched linear systems in Euclidean Space. Sufficient and necessary conditions for controllability and observability are established and their applications to linear switched control systems are also discussed.