

CONTROLLABILITY OF ABSTRACT NEUTRAL FUNCTIONAL DIFFERENTIAL SYSTEMS WITH INFINITE DELAY¹

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Abstract. This paper is concerned with the controllability of neutral functional differential systems with infinite delay in a general Banach space, via a fixed point approach. Sufficient conditions for controllability are established by using the Leray-Schauder Alternative. An example is given to illustrate the results.

Key words: Controllability, Neutral functional differential systems, Infinite delay, Phase spaces, Schaefer fixed-point theorem.

1991 Mathematics subject classification. 93C25, 34K30, 34K35.

1 Introduction

Controllability of linear and nonlinear systems represented by ordinary differential equations in finite-dimensional spaces has been extensively investigated. Since there are many examples where time delay and spatial diffusion enter control systems [7,8,16], several authors have extended the concept of controllability to infinite-dimensional systems in Banach spaces. Chukwu and Lenhart [6] widely studied the controllability of nonlinear systems in Banach spaces. Kwun et al. [11] discussed the approximate controllability for delay Volterra systems with bounded linear operators. Naito [12] established the controllability for nonlinear Volterra integrodifferential systems. Balachandran et al. [1-4] studied the controllability and local null controllability of Sobolev-type integrodifferential systems and functional differential equations in Banach spaces by using Schauder fixed-point theorem.

It should be pointed out that Balachandran et al. [5] studied the controllability of neutral functional integrodifferential systems in Banach spaces by using Schaefer fixed-point theorem. To our knowledge, most of the previous results for controllability are in connection with finite delays. Since many control systems arising from realistic models heavily depend on histories (i.e., there is the effect of infinite delay on state equations) [7,8,16], there is a real need to consider the controllability of partial functional differential systems with infinite delay.

¹PROJECT SUPPORTED BY NNSF OF CHINA(NO:19971026)