Topological **M**ethods in **N**onlinear **A**nalysis
Volume 66, No. 2, 2025, 389–433
DOI: 10.12775/TMNA.2024.060

L^p-EXACT CONTROLLABILITY OF ABSTRACT DIFFERENTIAL INCLUSION WITH NONLOCAL CONDITION

Bholanath Kumbhakar — Dwijendra Narain Pandey

Abstract. This paper addresses the $L^p([0,\nu],U)$ exact controllability of the abstract semilinear differential inclusion with nonlocal conditions within the context of a uniformly convex Banach space (U). By presuming exact controllability for the linear system, we apply an approximate solvability technique to reduce the problem to finite-dimensional subspaces. Consequently, the solutions for the primary problem are the limiting functions within these finite dimensional subspaces. The paper offers a unique solution to a challenge introduced by assuming U as a uniformly convex Banach space, which presents issues of convexity during the construction of the necessary control. Such issues are not present when U is a separable Hilbert space. Therefore, the paper's novelty is its successful resolution of the convexity problem, paving the way for $L^p([0,\nu],U)$ controllability of the semilinear differential control system in which U is a uniformly convex Banach space.

1. Introduction

Differential inclusions constitute an active branch of the general theory of differential equations. Differential inclusions, which emerged as a natural generalization of the concept of ordinary differential equations, have permeated various

2020 *Mathematics Subject Classification.* Primary: 34A60, 93B05; Secondary: 34H05.
Key words and phrases. Exact controllability; differential inclusion; nonlocal condition.
The first author is supported by Council of Scientific and Industrial Research, New Delhi, Government of India (File No. 09/143(0954)/2019-EMR-I).