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BIRKHOFF–KELLOGG AND FURI–PERA TYPE RESULTS FOR GENERAL CLASSES OF MAPS

Donal O'Regan[1]

[1]School of Mathematics, Statistics and Applied Mathematics
National University of Ireland, Galway, Ireland

Abstract. This paper presents a variety of Birkhoff–Kellogg type theorems and a Furi–Pera type result for a general class of maps.

Keywords.Φ–epi maps, coincidence, Birkhoff–Kellogg, Furi–Pera.

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1 Introduction

Epi maps were introduced in [4] and extended by a variety of authors (see for example [6, 8]). Using the notion of a Φ–epi map (see [8]) we establish a variety of Birkhoff–Kellogg type results for general classes of maps. In particular our results include those in [2, 3, 7, 10]. In addition in this paper we present a Furi–Pera type result for general classes of maps which improve results in the literature (see [1, 5, 9]).

2 Main results

In this section we present Birkhoff–Kellogg type results and a Furi–Pera type result.

Let E be a normal topological vector space and U an open subset of E. We first consider the classes $\mathbf{A}$ and $\mathbf{B}$ of maps.

Definition 2.1. We say $F \in A(\overline{U}, E)$ (respectively $F \in MB(\overline{U}, E)$) if $F : \overline{U} \to 2^E$ and $F \in \mathbf{A}(\overline{U}, E)$ (respectively $F \in \mathbf{B}(\overline{U}, E)$); here $\overline{U}$ denotes the closure of U in E and 2^E denotes the family of nonempty subsets of E.

Remark 2.1. We say $F \in MB(E, E)$ if $F : E \to 2^E$ and $F \in \mathbf{B}(E, E)$.

In this section we fix a $\Phi \in MB(\overline{U}, E)$.

Definition 2.2. We say $F \in A_{\partial U}(\overline{U}, E)$ if $F \in A(\overline{U}, E)$ with $F(x) \cap \Phi(x) = \emptyset$ for $x \in \partial U$; here ∂U denotes the boundary of U in E.