Clustering Techniques Performance for the Coordination of Adaptive Overcurrent Protections

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Abstract: Inclusion of distributed generation and topological changes in a network originate several operating scenarios. For this reason, techniques that adjust the configuration ... **View more**

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Abstract:
Inclusion of distributed generation and topological changes in a network originate several operating scenarios. For this reason, techniques that adjust the configuration of overcurrent relays have been developed in order to provide protection coordination strategies capable of operating in different schemes. However, the adjustments allowed by these devices are limited. Thus, scenario grouping techniques are proposed to reduce the number of required configurations. This paper aims to evaluate the performance of different grouping techniques with input parameters for coordination strategies of electrical overcurrent protections, where it is required to associate the different modes of operation of a distribution network. For the clustering process, unsupervised learning techniques such as K-means, K-medoids and Agglomerative Hierarchical Clustering were employed. Additionally, for the input characteristics, fault currents, nominal currents and other parameters obtained from the electrical system were taken into account. From the results obtained when evaluating different combinations of techniques and inputs, it is important to mention that the characteristics that describe the different modes of operation necessary for the grouping are decisive for the coordination strategies of electrical protections and that it is not possible to establish a significant difference between the clustering techniques evaluated. Lastly, the combination that presents the best performance was K-means;

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Manhattan and maximum short-circuit phase currents per relay with a sum of operation time of 428.72s and zero restriction violation.

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Contents

I. Introduction

There has been an accelerated increase in the implementation and integration of renewable energy sources into transmission and distribution networks [1]. As a result of the inclusion of new generation technologies, concepts such as Microgrid (MG) [2] and Active Distribution Network (ADN) arose [3], describing distinct dynamics between Distributed Generation (DG) and the existing electric system. Due to these particular interactions, traditional protection schemes are prone to the risk of failure by problems of fault current, bidirectional power flows, and topological changes, among others [4].

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