Integrating Evolutionary Optimization, Statistical Classification and Analysis of Reliability, Costs and Technical Losses into a Computational System for Optimal Design and Diagnosis of Electric Power Distribution Grids.

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ABSTRACT

Within the context of electric power distribution industry, the processes of design and management of power distribution grids demand constant upgrades for the purpose of improving efficiency. Increase power quality and reliability, reduce maintenance costs and energy losses, detect problems and their sources, design better configurations and achieve satisfactory rates in quality evaluations are common objectives that constitute an important and increasing challenge for the involved players.

Many mathematical and computational methods have been researched as auxiliary tools for helping companies to process available data to fulfil some of the mentioned objectives. This paper involves the study of such techniques, as well their integrated implementation in order to provide the prototype of a computational tool capable of analyse the structural, geographic and economic modelled data of a given power distribution grid and diagnose its eventual weaknesses to, finally, stipulate feasible improvement suggestions, serving as a Decision Support System (DSS).

Among the featured approaches, the statistical classification method "k_n–Nearest-Neighbor" [1], is applied to totalize the maintenance costs of a grid section through its associated consumer units data; a methodology proposed in [2] is used to stipulate a reliability measure through customer interruption costs; and Evolutionary Optimization [3], which is employed for searching optimal feasible grid configurations in order to improve one or more of its attributes, such as reliability, maintenance cost and technical losses.

The implemented program is tested using a data source which simulates a real case distribution company. At its conclusive section, the obtained results are presented and discussed, showing that the computational tool is viable and effective on its objectives and may constitute an interesting auxiliary product for power distribution grids design and decision support.

REFERENCES

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