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POWER LOSS REDUCTION THROUGH NETWORK RECONFIGURATION AND DISTRIBUTED GENERATION BY MEANS OF FEASIBILITY-PRESERVING EVOLUTIONARY OPTIMIZATION

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Abstract: Reduction of power losses and improvement of voltage profile in power distribution networks has been often approached by methodologies such as distribution network reconfiguration (DNR), capacitor bank placement and Volt/Var control [1]. Recently, optimal allocation of distributed generation (DG) has been taken into consideration as a method for grid support due to its attributions towards frequency drop stabilization [2], power loss reduction and voltage profile improvement [3]. Combination of multiple methodologies such as distribution reconfiguration and optimal allocation of DGs have been proposed to increase the benefits [4], [5]; however, the practical complexity of implementing such combination of methodologies increases significantly. The paper proposes a novel algorithm for power loss reduction through DNR and optimization-based allocation of DG sources. In this work, DNR is solved simultaneously with DG allocation. The problem at hand is a complex mixed-integer task. A customized evolutionary algorithm has been developed with recombination operators preserving a radial structure of the network, integer-based operators for DG placement, and floating-point operators for handling their power output capacities. Comprehensive numerical validation performed on standard IEEE 33- and 69-bus systems indicates that our methodology outperforms state-of-the-art algorithms available in the literature in terms of the obtained power loss reduction. Furthermore, it features good repeatability of results as demonstrated through statistical analysis of multiple algorithm runs.

Refrences:

[1] G. Gutiérrez-Alcaraz and J. H. Tovar-Hernández, "Two-stage heuristic methodology for optimal reconfiguration and Volt/VAr control in the operation of electrical distribution systems," IET Generation, Transmissio

[2] A. A. A. El-Ela, S. M. Allam, and M. M. Shatla, "Maximal optimal benefits of distributed generation using genetic algorithms," Electr. Power Syst. Res., vol. 80, no. 7, pp. 869–877, Jul. 2010

[3] N. A. M. Khairuddin and L. M. Cipcigan, "Optimal placement and capacity of distributed generators in medium voltage generic UK network," 2016 51st International Universities Power Engineering Conference (UPEC), Coimbra, 2016, pp. 1-6.

[4] R. Rakesh, P. VenkataPapana and S. Keerthi, "A hybrid algorithm for optimal allocation of DG in radial distribution system," 2017 IEEE Region 10 Symposium (TENSYMP), Cochin, 2017, pp. 1-5.

[5] R. S. Rao, K. Ravindra, K. Satish and S. V. L. Narasimham, "Power Loss Minimization in Distribution System Using Network Reconfiguration in the Presence of Distributed Generation," in IEEE Transactions on Power Systems, vol. 28, no. 1, pp. 317-325, Feb. 2013.