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Transmission expansion planning in the presence of wind farms with a mixed AC and DC power flow model using an imperialist competitive algorithm

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Abstract— Renewable generation and distributed resources are becoming increasingly relevant due to their various advantages and intense regulatory support. Therefore, there is a need to consider the effects of these new sources in the transmission network. In addition, the accurate assessment of losses is necessary in order to evaluate the impact of distributed generation. In this paper, we present a single-objective optimization method that is applied to different case studies that include an AC and a DC power flow in order to consider losses accurate and efficiently. The proposed algorithm considers uncertainty in wind generation and demand, as well as the costs for investment, repair, maintenance, and losses. This problem is solved using an Imperialist Competitive Algorithm (ICA), a meta-heuristic method that has been proposed recently and has shown promising results compared to the other well-established evolutionary methods such as Genetic Algorithm (GA). The proposed method is investigated on the IEEE 24-bus and IEEE 118-bus test systems. The results are compared to the results reported in the literature. Our results confirm that an accurate evaluation of losses using an ACPF does modify the optimal plan and hence it is important to include an ACPF when performing Transmission Expansion Planning (TEP). In addition, the implemented ICA displays a more efficient performance than a plan GA in the same case study.

Index Terms— Heuristics; Imperialist Competitive Algorithm (ICA); Monte Carlo Simulation (MCS); Transmission Expansion Planning (TEP); Wind farms

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