A probabilistic multi-objective approach for FACTS devices allocation with different levels of wind penetration under uncertainties and load correlation

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Abstract

This study presents a probabilistic multi-objective optimization approach to obtain the optimal locations and sizes of static var compensator (SVC) and thyristor-controlled series capacitor (TCSC) in a power transmission network with large level of wind generation. In this study, the uncertainties of the wind power generation and correlated load demand are considered. The uncertainties are modeled in this work using the points estimation method (PEM). The optimization problem is solved using the Multi-objective particle swarm optimization (MOPSO) algorithm to find the best position and rating of the flexible AC transmission system (FACTS) devices. The objective of the problem is to maximize the system loadability while minimizing the power losses and FACTS devices installation cost. Additionally, a technique based on fuzzy decision-making approach is employed to extract one of the Pareto optimal solutions as the best compromise one. The proposed approach is applied on the modified IEEE 30-bus system. The numerical results evince the effectiveness of the proposed approach and shows the economic benefits that can be achieved when considering the FACTS controller.

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