

Probabilistic assessment of D-STATCOM operation considering correlated uncertain variables

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Abstract-

Renewable energy sources (RESs) such as wind turbines (WTs) and photovoltaic (PV) cells have become more widespread in recent years due to their superior technical, economical, and environmental benefits. These types of energy sources are innately unpredictable, owing to the uncertain nature of their primary resources and bring about more challenges in the distribution networks. Moreover, there may be a high correlations between uncertain input variables which intensify the mentioned challenges. On the other hand, power electronic-based devices have had an effective role in improving the performance of distribution networks. Distribution network flexible AC transmission system (D-FACTS) devices such as distribution static compensator (D-STATCOM) can be efficiently used for making the modern distribution networks with high penetration of RESs more flexible. In this article, probabilistic assessment of the D-STATCOM operation is considered in the distribution networks, including RESs such as WT and PV cells. For this purpose, the probabilistic extended forward-backward load flow with D-STATCOM modeling has been introduced. The uncertainties are considered in power demands, wind speed, and solar radiation. Also, the correlations between uncertain variables are taken into account. Probabilistic assessment for this problem is conducted by k-means based data clustering method for the first time. In addition to the comparison of the results with the Latin hypercube sampling, the results are validated with the Monte Carlo simulation method as a reference technique. The IEEE 33-node and 69-node test networks are used as case studies and show the effectiveness of the proposed method.

Index Terms-

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