

Validation of synthetic U.S. electric power distribution system data sets

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Abstract-

There is a strong need for synthetic yet realistic distribution system test data sets that are as diverse, large, and complex to solve as real systems. Such data sets can facilitate the development of advanced algorithms and the assessment of emerging distributed energy resources while avoiding the need to acquire proprietary critical infrastructure or private data. Such synthetic data sets, however, are useful only if they are realistic enough to look and behave similarly to actual systems. This paper presents a comprehensive framework for validating synthetic distribution data sets using a three-pronged statistical, operational, and expert validation approach. It also presents a set of statistical and operational metric targets for achieving realistic data sets based on detailed characterization of more than 10,000 real U.S. utility feeders. The paper demonstrates the use of the proposed validation approach to validate three large-scale synthetic data sets developed by the authors representing Santa Fe, New Mexico; Greensboro, North Carolina; and the San Francisco Bay Area, California.

Index Terms- Electric distribution test feeders, synthetic data sets, validation, statistical metrics, power flow, smart grid use case.

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