

# **A review of power distribution test feeders in the United States and the need for synthetic representative networks**

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## **Abstract-**

**Under the increasing penetration of distributed energy resources and new smart network technologies, distribution utilities face new challenges and opportunities to ensure reliable operations, manage service quality, and reduce operational and investment costs. Simultaneously, the research community is developing algorithms for advanced controls and distribution automation that can help to address some of these challenges. However, there is a shortage of realistic test systems that are publically available for development, testing, and evaluation of such new algorithms. Concerns around revealing critical infrastructure details and customer privacy have severely limited the number of actual networks published and that are available for testing. In recent decades, several distribution test feeders and US-featured representative networks have been published, but the scale, complexity, and control data vary widely. This paper presents a first-of-a-kind structured literature review of published distribution test networks with a special emphasis on classifying their main characteristics and identifying the types of studies for which they have been used. This both aids researchers in choosing suitable test networks for their needs and highlights the opportunities and directions for further test system development. In particular, we highlight the need for building large-scale synthetic networks to overcome the identified drawbacks of current distribution test feeders.**

**Index Terms-** distribution networks; review; state of the art; test feeders; representative networks; distributed energy resources (DERs); synthetic distribution test feeders

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