## Building large-scale U.S. synthetic electric distribution system models

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## Abstract-

Rapid increases in distributed energy resources on distribution systems are prompting research efforts to improve and evaluate electric power distribution algorithms; however, there is a shortage of realistic, large-scale, U.S.-style test systems for the evaluation of such advanced algorithms. Some available tools to build large-scale test systems are of European style, and their application to studies focused on the United States might not be desirable given very different characteristics between the European and U.S. distribution designs. Motivated by this need, this paper develops detailed algorithms to build large-scale U.S. distribution systems and incorporates them in a new Reference Network Model, RNM-US. The approach starts with information from street maps and a catalog with electric equipment that includes power lines, transformers, voltage regulators, capacitors, and switching devices. The paper presents the algorithms through an illustrative case study of the different steps that comprise the process of building a synthetic distribution grid. Finally, the paper presents a medium-and a large-scale data set covering 10 million electrical nodes and 120,000 km of power lines, demonstrating the applicability of the proposed method to build very large-scale synthetic distribution systems.

Index Terms- Distribution system; synthetic system; test feeder; power utility; power flow; power system; Reference NetworkModel, representative system

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