

A complex-network approach to the generation of synthetic power transmission networks

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Abstract— The application of complex-network techniques to the analysis of power grids can provide interesting complementary insights into power studies such as the generation of synthetic power grids. Synthetic power grids are realistic, albeit nonreal, case studies that are topologically consistent with respect to real power networks. As a preliminary step to the generation of synthetic power grids, we use complex-network techniques to analyze several European power networks from a topological point of view. We observe that real topologies are markedly heterogeneous. Then, we present our main contribution: a novel model that generates synthetic spatial power networks that mimics the historical evolution of power systems by taking into account economic and technical factors. The model is articulated in two steps—the first step focused on economic efficiency in which power demand is met and the second one is targeted at increasing network robustness while achieving topological attributes. The resulting synthetic networks are topologically consistent with real power grids. The parametrical nature of the proposed model allows the generation of different instances of consistent power networks, a very interesting feature for grid generation.

Index Terms— Complex networks, network topology, power grids, power systems, topology.

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