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Topologies that favor synchronization in energy transmission networks

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Abstract: Energy transmission networks (power grids) are a typical example of the study of a system that presents a collective behavior of interconnected dynamical units. Local instabilities in these networks can result in cascade failures and even in blackouts. Power grids can be described my means of complex networks of oscillators, where transmission lines are described by the edges and generators or consumers of energy are represented by nodes. The oscillator model often used in literature to describe the behavior of the generators/consumers is the second order Kuramoto model. In this work, an evolutionary optimization technique is used to generate network topologies that present a relatively small number of edges and favors frequency synchronization as the dynamics of the nodes are given by a second order Kuramoto oscillator. These topologies would be of great interest when building power grids duo to the costs involved in the construction of transmission lines.

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