[P3] Synchronization Dynamics of Kuramoto Model with Inertia on Power Grids

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Power grid has often been understood as an oscillatory network and its dynamic behavior has been of interest to researchers. Synchronization of the angular frequency between power-grid nodes is one of the essential conditions for the stable power systems such that many studies analyzed synchronization phenomenon particularly in the frame of power grid. Kuramoto model with inertia enables us to simulate the synchronization phenomena on power grids [1, 2]. One of the applications is the stability measure of the synchronization based on the volume of the basin of attraction—basin stability [1]. Previously, the correlation between basin stability and the amount of power input or damping coefficient is analyzed [3, 4]. In this study, we investigate the transition pattern of the synchronization stability according to the coupling strength which corresponds to the transmission capacity in power-grid. We widely scan the basin stability for a given range of transmission capacity and correlate the pattern to the network characteristics of power-grid nodes. We use both simple network motifs with 2, 4 and 6 nodes and the real power grid structure of Chile. We find that the transition pattern is closely related with meso-scale network characteristics rather than micro- or macro-scale network characteristics [5, 6]. In addition, we investigate the anomalous increase of synchronization stability at the moderate level of transmission strength.

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