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Estimating the Severity of Cascading Failures Induced by Multi-Node Attacks in the Power Grid[1] ALAA MOUSSAWI, NOEMI DERZSY, Department of Physics, Rensselaer Polytechnic Institute, XIN LIN, BOLESLAW SZYMANSKI, Department of Computer Science, Rensselaer Polytechnic Institute, GYORGY KORNISS, Department of Physics, Rensselaer Polytechnic Institute, SOCIAL AND COGNITIVE NETWORK ACADEMIC RESEARCH CENTER TEAM
— Maintenance of power grid stability is essential for the success of global infrastructure, making prevention of cascading failures a high priority. Predicting the severity of cascading failures in a time frame enabling response is an essential part of mitigating risks present in the power grid. For a network of size N, there are 2^N different failure scenarios that can induce cascades in the network, a rapidly increasing number even for small network sizes. Thus far, methods of predicting network cascade extent based on initial network conditions have shown very meager results. We propose a method of estimating the severity of cascading failures induced by multiple node failures based upon the severities of the failures induced by the same number of single node failures in the network. Results show a strong correlation between the sum of the severity of the cascades induced by f individual nodes, and the severity of a cascade induced by the simultaneous failure of all f nodes. As the number of nodes inducing the multi-node failure increases, this correlation weakens. We approximate the extent of all 2^N cascade scenarios by sums of damages of the N single node failures, suggesting methods of estimating the general robustness of a given power grid.

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