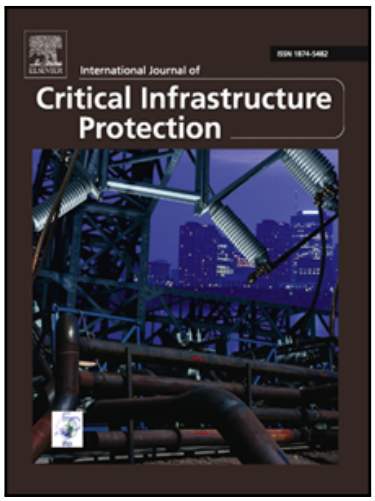

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Distributed monitoring for the prevention of cascading failures in operational power grids

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Abstract

Electrical power grids are vulnerable to cascading failures that can lead to large blackouts. The detection and prevention of cascading failures in power grids are important problems. Currently, grid operators mainly monitor the states (loading levels) of individual components in a power grid. The complex architecture of a power grid, with its many interdependencies, makes it difficult to aggregate the data provided by local components in a meaningful and timely manner. Indeed, monitoring the resilience of an operational power grid to cascading failures is a major challenge.

This paper attempts to address this challenge. It presents a robustness metric based on the topology and operative state of a power grid to quantify the robustness of the grid. Also, it presents a distributed computation method with self-stabilizing properties that can be used for near real-time monitoring of grid robustness. The research thus provides insights into the resilience of a dynamic operational power grid to cascading failures during real-time in a manner that is both scalable and robust. Computations are pushed to the power grid network, making the results available at each node and enabling automated distributed control mechanisms to be implemented.

Keywords

Power Grids; Cascading Failures; Robustness; Real-Time Monitoring; Dis-

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