NEW OPTIMIZATION ALGORITHM FOR CONTROLLING CASCADING FAILURES IN POWER SYSTEMS[1]

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Power systems are in the core of the infrastructure of modern society. The reliability of a large number of life-support systems depends on the entire power systems reliability and it components functioning. However, the complexity of such networks makes it difficult to manage them, and parts of the network might fail. E.g. the blackout that occurred on August 14th, 2003 in the US and Canada due to both a lack of coordinated countermeasures and too long a delay between the initial emergency and the countermeasures taken, transmission lines started failing, causing a cascade of failures. The main means of counteracting the development of such severe outages in Electrical Power Systems (EPS) are so-called Emergency Control Systems (ECS). In general, ECS can be divided into centralized and local systems. A centralized ECS is a complex information system, whose main task is to provide control actions for a number of different types of disturbances offline. Typically, centralized ECS collects information on the current state of the EPS, and based on a detailed analysis of the current situation calculates coordinated control actions for a large set of possible disturbances. However, their reliability depends on many communication channels. Moreover, the rate of decision making strongly depends on the transmission speed of the slowest information channel. Due to delays in computation and the dynamical nature of the power system, the returned control actions might not be valid anymore. Finally, different power companies might put restrictions on the centralization and accumulation of information due to confidentiality requirements. Local ECS are devices that implement control actions on the basis of local information of the current state. Although their decision times are quite fast, the uncoordinated nature of their actions can create a catastrophic deterioration of the emergency due to cascading failures. In particular, recent studies have shown that the main reason for most of the recent blackouts was a cascade tripping of transmission lines due to overload [1]. Thus, there is a need to supplement existing control methods with new one that can react better and faster to changes than centralized ECS, while still being able to provide a better coordinated solution than existing local ECS can provide. The paper proposes a new optimization algorithm for load shedding to eliminate overloads in electric power systems. Lets outline the main features of proposed algorithm. 1) An optimal balance between complexity and simplicity: it is generic enough to provide high level of control actions precision and it is simple enough to meet strict time restrictions. 2) It meets high level of reliability: it does not fail in the case of the uncritical loss of information. High speed of self-healing monitoring is provided by the maximum simplification of the algorithm.
This is a joint work with O. Khamisov, D. Sidorov, N. Tomin and A. Osak.

REFERENCES

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[1]This work is partly supported by RSF, project No. 14-19-00054