ABSTRACT

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The characteristic of self-healing, in smart grids, consists of finding a proposal for a reconfiguration of distribution system aiming at restoring the power, partially or completely to supply the network clients, in the event of network failure, which compromises the energy supply. The search for a satisfactory solution is a combinatorial problem whose complexity is proportional to the network size. An exhaustive search-based method is a time-consuming process and often computationally not viable. To overcome this difficulty, techniques for generating minimal spanning trees of the graph, which represents the smart grid, are exploited. However, the majority of studies in this area provide centralized implementations, where the solution for reconfiguration is achieved by a central control system. In this dissertation, we propose a distributed implementation, where each of the network switch collaborates in the development of the solution for reconfiguration. The proposed decentralized solution seeks a reduction in terms of the network reconfiguration time, in case of a single or multiple failures, thus increasing network intelligence. In this purpose, the GHS distributed algorithm is used as a basis for developing a self-healing solution to be embedded in the processing elements that are included within the line commutation switches of smart grid. The proposed solution is implemented using robots as processing units, which communicate via the same network, thereby creating a distributed processing environment. The several tested case studies show that, for smart grids that to have a single distribution feeder, the proposed solution allowed for a successful reconfiguration of the network, regardless of the number of simultaneous failures. In the proposed implementation, the network reconfiguration time does not depend on the number of buses and lines included. The implementation presents results of communication cost and time within the theoretical bounds of the GHS algorithm.

Keywords: Self-healing. Minimum spanning tree. Distributed computing. Smart grids distribution. GHS algorithm.