

DOCTORAL THESIS INFORMATION

Title of thesis: DISTRIBUTION NETWORK RECONFIGURATION USING METAHERUSTISTIC OPTIMIZATION ALGORITHMS

Major: Electrical Engineering

Code: 62520202

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Thesis summary:

The thesis presents the distribution network reconfiguration (DNR) problem using meta-heuristic optimization algorithms with the aim of reducing active power loss and improving voltage quality to satisfy the system's constraints. The DNR problems were formulated with single and multi-objective functions while taking into account the presence of distributed generation (DG). The thesis considered many scenarios for the proposed DNR problems and the complexity of the constraints also gradually increased to test the effectiveness of the proposed methods. The contributions of the thesis are considered as follows:

- The Stochastic Fractal Search (SFS) and Symbiotic Organisms Search (SOS) algorithms were successfully applied to solve the DNR problem considering the presence of DG with a single objective function.
- The Chaotic SFS (CSFS) algorithm was successfully applied to the DNR problem with single objective function.
- Three algorithms including SFS, SOS, and CSFS were successfully applied to the practical DNR problem with a single objective function.
- The multiobjective algorithm, namely Nondominated sorting SFS (NSSFS), was developed in the thesis to solve the DNR problem considering the presence of DG with multi-objective functions.

Practical application

The applications of SFS, CSFS, SOS and NSSFS algorithms to solve the single-objective and multi-objective DNR problems have brought an effective calculation tool based on artificial intelligence algorithms for distribution network operators (DNOs) in the planning and operation of distribution networks. Considering many scenarios of the DNR problem will help DNOs have many different choices. Therefore, planning and operating distribution networks more effectively.

The thesis applied the SFS, CSFS, and SOS algorithms to a practical distribution network in Tan Chau district, Tay Ninh province, Vietnam with 272 nodes for two cases: considering and without considering the presence of DG.

Future research directions

- Improving the SFS, and SOS algorithms to deal with the large and complex problems, and considering new forms of energy such as storage systems, and charging stations for electric vehicles,...

- Applying new optimization algorithms and combining different algorithms to solve the DNR problem

- Considering new problems to the DNR problem: improving the reliability of power supply, restoring power supply through the opening and closing of switches on a loop structure of distribution networks, considering the effects of DG and economic efficiency factor.