論　文　要　旨
Thesis Abstract

(yyyy/mm/dd)　　年　　月　　日

※報告番号	甲 第　２０７号	氏　名 (Name)	NGUYEN PHUC KHAI

主論文題名　（Title）

Economic planning and operation in electric power system using meta-heuristics based on Cuckoo Search Algorithm

内容の要旨　（Abstract）

The main purpose of this thesis is to propose an improved Cuckoo Search Algorithm and evaluate it on various economic problems of the electric power system in order to investigate its effectiveness. Cuckoo Search Algorithm is a meta-heuristic developed by Yang and Deb since 2009. This method is based on the Levy distribution to generate new solutions and illustrate the process of Cuckoo's reproduction strategy to carry better solutions over the next generation. In this study, the proposed method gives a chance for Cuckoo eggs to modify itself following better solutions to enhance the performance. A learning factor p_l is employed to control the modification stage of Cuckoo eggs and prevent the search engine fall into local optimum points. Thus, the proposed is named Self-Learning Cuckoo Search Algorithm.

In order to investigate the efficiency, Self-Learning Cuckoo Search Algorithm is evaluated on four common economic problems on the power system. The first application is the Multi-Area Economic Dispatch. The objective of this problem is to minimize the total fuel cost when combining power systems of many areas together while satisfying the power balance in each area. This problem consists of many non-convex fuel cost functions, such as multi-fuel cost function, the functions considering valve-point effects or prohibited operating zone. Numerical results of three case studies show that the proposed method is better than the conventional Cuckoo search algorithm.

The second obtained problem is the Optimal Power Flow, which is the major tool to operate and analyze the power system. This problem determines power and voltage of generators to minimize the total fuel cost while handling a huge of equal and unequal operational constraints. Self-Learning Cuckoo Search Algorithm is evaluated up to the IEEE 300-bus system to investigate its efficiency on large-scale problems. Numerical results show that the proposed method is successful in solving the large-scale problem while the conventional is unsuccessful.

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Thirdly, Self-Learning Cuckoo Search Algorithm is evaluated on the Optimal Reactive Power Dispatch. This problem is a special type of the Optimal Power Flow when its objective function is to minimize the total power loss. According to numerical results of 30, 57- and 118-bus systems, the proposed method keeps giving better solutions than the conventional.

The final problem is the optimal sizing and placement of shunt-VAR compensators. This problem has multiple objectives and combines integer and real numbers together. In this study, Self-Learning Cuckoo Search Algorithm is compared with the Teaching-Learning based Optimization, Particle Swarm Optimization, Improved Harmony Search and the conventional Cuckoo Search Algorithm.

According to numerical results of obtained problems, the proposed Self-Learning Cuckoo Search Algorithm is better than the conventional in giving the optimal solutions, especially on large-scale systems. Thus, the proposed method is favorable to apply for practical operation.

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