# SUMMARY OF Ph.D. DISSERTATION

| School | Student Identification Number | SURNAME, First name<br>KEN-ICHI Tokoro |
|---|---|---|

Title

Improving convergence performance of genetic algorithms for large-scale optimization problems

－application to optimization problems in electric power systems－


Abstract

This thesis proposes genetic algorithms (GAs) to efficiently solve typical large-scale optimization problems arising in electric power systems such as an assignment problem, a mixed integer non-linear programming problem, and a stochastic programming problem. The improvement of computer performance and the development of meta-heuristics have made it possible to solve a complex problem in a reasonable computation time. GA is one of representative meta-heuristics, and has been applied to solve various problems in electric power systems. However, the convergence performance of GA is not quite enough to obtain a practical solution of actual large-scale problems. This thesis proposes three types of algorithms, based on GA, that solve typical large-scale optimization problems in electric power systems.

This thesis is organized as follows.

Chapter 1 describes the purpose of this thesis and summarizes related preceding studies.

Chapter 2 provides an overview of GA, prerequisite for the argument in this thesis.

Chapter 3 proposes a hybrid algorithm of GA and greedy algorithm to solve large-scale assignment problems. In the algorithm, the assignment order is determined by the combination of two priorities, one is coded in a chromosome and another is calculated by a greedy algorithm. We apply the proposed algorithm to a large-scale frequency assignment problem of the mobile communication system of electric power companies. In this problem, we attain the optimal frequency assignment that minimizes the required number of frequencies.

Chapter 4 describes a GA to solve a mixed integer non-linear programming problem, e.g. a unit commitment problem of power plants. In the algorithm, a partial solution of the problem is encoded in a chromosome of an individual. In the partial solution, values of some integer variables are fixed while others are not. In the evaluation step of GA, values of unfixed integer variables and continuous variables are determined based on a solution of a continuous relaxation. The proposed GA finds a solution better than those found ever by the existing method for the case with a large number of power units.

Chapter 5 proposes a GA to solve a complex stochastic programming problem, in which random parameters are represented by a huge number of scenarios. To save the computation time, the algorithm evaluates individuals based on the mean fitness for some scenarios sampled at random. In order to reduce the influence of sampling error, the selection in the algorithm is carried out based on the statistical theory. The GA significantly reduces the computation time required to find high quality solutions for stochastic facility location problems in electric power company.