UNIVERSITI TEKNOLOGI MARA

IMPROVED ELITIST GENETIC ALGORITHM FOR REACTIVE POWER PLANNING IN POWER SYSTEM

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ABSTRACT

This thesis presents a newly developed technique for the improvement of the elitist binary genetic algorithms (EGA) in implementing the reactive power planning (RPP) in power system. The genetic algorithm (GA) is a search technique based on the behaviour of natural genetics. The study conducts comparative analyses on the performances of the elitist genetic algorithms (EGA). Modified steady state genetic algorithms (SSGA) and computationally enhanced steady state genetic algorithm (CSGA) in improving the voltage stability and minimizing loss via the optimization of the RPP in power system.

Elitism is one of method implemented to improve the accuracy of the solution and computation time of the GA. The application of elitism in GA constitutes the deployment of the elitism mechanism in the selection scheme or genetic operator. The elitist mechanism guarantees that the best fitness of the population discovered in the earlier generation will never disappear unless a better solution is found. The EGA ensures the quality of the solution never deteriorates as the generations progress since the fittest solution of the current population is duplicated in the subsequent generations. It may strike a fair balance between exploitation and exploration in achieving an acceptable optimum solution with an appropriate population composition. Any result inferior to the reading produced by the EGA shall be considered as a premature convergence onto a local optimum. However, the EGA has the weakness of a moderate convergent rate despite of a good search performance. The study adopts the reading produced by the EGA as the benchmark for drawing any judgment towards developing the improved EGA.

The concept of employing an elitism mechanism in the cross breeding and mutation operations is referred as steady state elitism. An elitist selection scheme and a steady state mechanism are incorporated into the development of the SSGA. The SSGA is time efficient but biases toward exploitation whereby more highly fit chromosomes are

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Power system network can become heavily congested with increasing demand. The increasing number of voltage collapse occurrences due to voltage instability phenomena has motivated further research in the area of voltage stability in power system [1]. Voltage stability refers to the ability of a power system to sustain steady acceptable voltages at all buses in the system at normal operating conditions after being subjected to interference [2]. Among the possible interferences are line outage, generator outage, load shedding, stress condition and change of load [3]. The main consequences of voltage instability phenomenon are high transmission loss, low voltage profile and possibility of voltage collapse [3]. Voltage collapse phenomenon may be related to the action of tap-changes of transformers, current limiting generators, unpredicted escalation in the load level and also due to unexpected loss of an important transmission line, transformer or generator [4]. The increasing demand of electric power energy and the presence of disturbances are also identified as the factors of voltage instability condition in a power system [1]. The stressed condition in a power system is also due to the lack of reactive power support in the power system [1].

Optimization is a technique of finding the best possible solution to an optimization problem within a given time frame. An optimization problem is a problem for which there are different possible solutions and those solutions can be sensibly compared and contrasted. Optimization adjusts the inputs to a mathematical process or experiment to find the minimum or maximum output or result. It constitutes of testing variations on earlier concept or input to improve on the process or experiment. This can be comprehended as a thorough search through a prospective solution space. On the other hand, optimization is not possible when there is only one way to perform a task with no other alternatives. Another vital and difficult task in an optimization process is