UNIVERSITI TEKNOLOGI MARA

ENVIRONMENTALLY CONSTRAINT ECONOMIC DISPATCH AND REACTIVE POWER PLANNING FOR ENSURING SECURE OPERATION IN POWER SYSTEM

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Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Economics and efficient energy dispatch management is necessary to address the increase in energy demand within a limited energy resources while maintaining secure power system operation. Many researches have been conducted to overcome the issues in the implementation of Economic Dispatch (ED). Conventionally, ED problems concern with minimization of total costs while satisfying several operational constraints. In this research, a new optimization technique namely the Adaptive Tumbling Bacterial Foraging Optimization (ATBFO) technique was developed to solve the ED problems. In solving for the ED problems, the impact to the environment was also taken into consideration. Hence, the ED problem is termed Secured Economic Environmental Dispatch (SEED), in which the objective of the optimization now not only minimizing the cost of generation, but also ensuring minimum emission to the environment as well as reducing the total system losses. These objective functions were first considered individually and then were combined to be one multi objective function using the weighted sum approach. The multi objective technique is called Multi objective ATBFO or MOATBFO. The application of the developed optimization technique was extended to solve the Reactive Power Planning (RPP) problems. The objective of conventional RPP problems is to minimize the total power losses in a system. However, in this study, the aspect of security was also taken into consideration in terms of voltage stability condition in solving RPP problems. Hence, the RPP problem is now termed as security constrained RPP (SCRPP). In order to ensure maximum benefit would be obtained as a result of ED and RPP implementation in terms of generation cost minimization, total power losses minimization, while ensuring secure operating condition and minimum impact to environment, the proposed ATBFO and MOATBFO were utilized to solve for the Hybrid of SEED and SCRPP problem. An additional objective function was also taken into consideration in this which is maximum loadability improvement. The performance of the proposed techniques were used in solving SEED, SCRPP and Hybrid of SEED and SCRPP (HSEEDRPP) problems for the IEEE 118 bus system and also the IEEE 57 bus system. The comprehensive analyses were also conducted between two other familiar optimization methods known as original Bacterial Foraging Optimization (BFO) algorithm and Meta heuristic Evolutionary Programming (Meta-EP). From the results it shows that the multi objective ATBFO optimization is able to give better overall improvement in the objective functions for SEED, SCRPP and Hybrid of SEED and SCRPP problems.

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