# UNIVERSITI TEKNOLOGI MARA

# COMPUTATIONAL INTELLIGENCE BASED TECHNIQUE FOR CONGESTION MANAGEMENT AND COMPENSATION SCHEME IN POWER SYSTEM

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# ABSTRACT

Congestion problem is a crucial issue in power system. Its occurrence is closely related to loss increment and voltage decay in power system. The increment of load in a transmission system is one of the main factors that causes current increase. This leads to loss increment, while at the same time affecting the congestion event in the system. The impact leads to the increment in generation cost during congestion. Therefore, congestion management needs to be performed properly in order to deliver enough power to the system resulted by transmission line congestion. Failure to handle this situation may lead to bigger problems such as voltage collapse and cascading blackout. This thesis presents computational intelligence-based technique for congestion management and compensation scheme in power systems. In this study, a new model termed as Integrated Multilayer Artificial Neural Networks (IMLANNs) is developed to predict congested line and voltage stability index separately. Consequently, a new optimization technique termed as Clonal Evolutionary Particle Swarm Optimization (CEPSO) was developed. CEPSO integrates the element of cloning and swarm in the original Evolutionary Programming algorithm. CEPSO is initially used to optimize the location and sizing of FACTS devices for compensation scheme. In this study, Static VAR Compensator (SVC) and Thyristor Control Static Compensator (TCSC) are the two chosen Flexible AC Transmission System (FACTS) devices used in this compensation scheme. Multi-unit of SVCs and TCSCs have been separately installed in power system for the loss minimization and voltage profile improvement in two independent objective functions. The breadth and depth of the study are expended to the next contribution. A multi-objective CEPSO denotes as MOCEPSO algorithm is developed. MOCEPSO is utilized to solve multi-objective problem namely the minimization of loss and cost. Weighted sum technique has been incorporated to address this issue. All the components in this study have been validated in two Reliability Test System (RTS) namely the IEEE 30-Bus RTS and IEEE 118-Bus RTS. Comparative studies have been conducted between the proposed CEPSO and traditional Particle Swarm Optimization (PSO). Results obtained by the developed IMLANNs demonstrated high accuracy with respect to the targeted output. Consequently, the proposed CEPSO implemented for single objective in single and multi-units of SVCs and TCSCs has resulted superior results as compared to the traditional PSO in terms of achieving loss reduction and voltage profile improvement. In addition to that, the proposed MOCEPSO for solving multi-objective problems involving loss and cost minimization has outperformed the MOPSO technique. Results from this study can be beneficial to power system operators and planners. For future studies, the proposed technique can be further utilized to solve other power system problems involving optimization process with necessary modification.

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