

UNIVERSITI TEKNOLOGI MARA

**EVOLUTIONARY PROGRAMMING (EP) BASED
TECHNIQUE FOR SECURE POINT
IDENTIFICATION WITH LOAD SHEDDING
TECHNIQUE IN POWER TRANSMISSION
SYSTEM**

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Candidate's Declaration

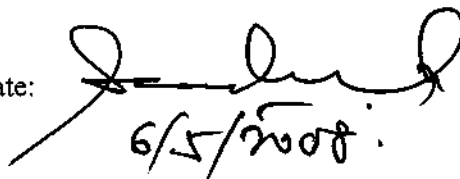
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ABSTRACT

Voltage stability has been identified as a crucial issue in power system study which has been identified as one of the causes that lead to cascading power system blackout in many parts of the world. This phenomenon has made this subject a very relevant issue in power system planning and operation.

This thesis presents the Evolutionary Programming (EP) based technique for secure point identification with load shedding technique in power transmission system. The study was initiated by the development of new algorithm for automatic voltage stability assessment (AVSA). This algorithm is used to estimate the maximum loadability point in power system. Consequently, another algorithm for maximum loadability identification using EP optimization technique was also developed. Several load buses have undergone maximum loadability tests for the determination of secure point prior to system instability occurrence, which may lead to possibility of voltage collapse in the system. In highlighting the merit of the proposed EP based technique for maximum loadability identification, established artificial immune system (AIS) optimization technique and AVSA were utilized for comparative studies purposes. The strength of EP in this study was evaluated in terms of its capability to search for the accurate solution and fast computation time. Consequently, the algorithm for load increase simultaneously at several load buses was also developed in order to search the optimal value at each bus in a system such that the system can maintain a stable condition. The ability of EP to search for the optimal values of multi-load increase as compared to AVSA which is only able to conduct uniform load increase at several load buses has been identified as the strength of EP over AVSA.

A published pre-developed Fast Voltage Stability Index (FVSI) was utilized as the instrument to indicate the voltage stability condition in both the maximum loadability identification and load increase at several load buses. Load shedding algorithm was also developed based on the voltage depreciation which makes the system suffers due to instability event; in the attempt of avoiding total collapse to the system. The optimal value of load amount to be shed is determined using EP to restore the system

stability. FVSI was proposed to indicate the highest risk voltage at particular load bus in order to implement load shedding for avoiding voltage collapse when subjected to disturbance. In realizing the effectiveness of the overall proposed techniques in this study, IEEE Reliability Test Systems (RTS) were taken as the test specimens.

Results obtained from the proposed maximum loadability identification, load increase at several load buses, load shedding technique based on the EP optimization technique have been revealed as the strength of EP in solving non-linear optimizations problems.

Therefore the contributions of the study can be summarized as follows:-

- Development of new algorithm for automatic voltage stability assessment (AVSA).
- Development of new algorithm for maximum load ability identification.
- Development of new algorithm for maximum capacity identification at several load buses.
- Development of Evolutionary Programming optimization engine to identify maximum loadability in power system.
- Development of Evolutionary Programming optimization engine to identify maximum capacity of multi-load increase.
- Development of load shedding algorithm based on a pre-developed line voltage stability index as voltage risk indicator to avoid voltage collapse.
- Implementation of Evolutionary Programming technique for optimal load shedding scheme.

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