UNIVERSITI TEKNOLOGI MARA

AN ARTIFICIAL NEURAL NETWORK BASED TECHNIQUE FOR EVALUATING THE EFFECT OF GENERATOR OUTAGE CONTINGENCIES

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Thesis submitted in fulfilment of the requirements
for the degree of
Master of Science

Faculty of Electrical Engineering

November 2007

ABSTRACT

This thesis presents the development of a fast and accurate approach using Artificial Neural Network Based Technique to evaluate the performance of power system during forced generator outages incident. Prior to the forced generator outages, the power system could be in stable state or unstable state. In this research, the evaluation of a power system performance was measured through the voltage, frequency and angle of the system. Dynamic analysis using Power System Simulator (PSS/E) was conducted by considering generators on forced outages in the initial base cases. Selection of the total generations to be put on forced outages was in the range of 300 MW to 2100 MW for single and/or combined unit of generators, which is based on the size of total installed generator in the system at the time of this study. The PSS/E output results were analyzed following the stability criteria. The criteria used as the reference in this analysis are: –180 ° to +180 °, 47.5Hz to 52.5 Hz, and 1.0 per unit to 1.05 per unit for rotor angle displacements of the machines, frequency and voltages, respectively. The results were translated into two status known as stable and unstable, represented by '1' to indicate stable and '0' to indicate unstable. These results were recorded and were used to develop an Artificial Intelligence System by predicting the system stability due to forced generator outages to automate the process. The developed program was tested on the Malaysian Grid System using six inputs and twelve outputs. The six inputs includes the seven days that are coded into binary numbers starting from 0 0 1 until 1 1 1 followed by time, demand and number of cases of forced generator outage. The demand patterns are chosen from 1100 hours to 1600 hours with fourteen selected worse case of generator outages. The outputs are the voltage (v), frequency (f) and angle (a) defined as '1' for stable and '0' for unstable and it is monitored at four areas of the grid system which are the North, East, Central and South. In each area there are three sets of results named as Nv, Nf, Na for North, Ev, Ef, Ea for East, Cv, Cf, Ca for Central and Sv, Sf and Sa for South in which it total up to twelve outputs.

The results obtained have shown that the Artificial Neural Network (ANN) provide a fast and relatively accurate dynamic stability evaluation in the event of generator on forced outages. The outcome of this research will contribute to an automated and more efficient process in evaluating the dynamic stability of the system due to forced generator outages. This will improve the time taken to perform the analysis. Decision can also be made in a fast manner and thus report could be produced on time.

Keywords:

Generators on Forced Outages, Dynamic Stability Analysis, Stability Criteria, Artificial Neural Network (ANN)

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