CHAPTER I

INTRODUCTION

1.1 Background

A reliable, continuous supply of electric energy is an essential part of today's complex societies. Due to a combination of increasing energy consumption and impediment of various kinds to extension of existing electric transmission network, these power systems are operated closer to their limit. This situation requires a significantly less conservative power operation and control regime which, in turn, is possible only by monitoring the system state in much more detail than was necessary previously.

Secure power system means freedom from danger or risk. However, power system can never be secure in absolute sense. Accordingly, in power system context, security can only be a qualified absence of risk, specifically or risk of disruption of continued system operation. Thus security has come to means the ability of the system to withstand without consequences any one of a preselected list of "credible contingencies. From a control perspective, the objective of power system operation is to keep the electric power flows and bus voltage magnitudes and angles within acceptable limit, despite changes in load or available resources. In August 2003 [1], power plants separated by hundreds miles in north-east of the US and in Canada were suddenly disconnected by their own safety system from the vast power network that cover those countries. In few minutes the power failed in Cleveland and the light went out in New York and across nine states in the US. It has been found that the blackout happened because of oscillation in the power network could be the echoes from a lightning strike with poorly tuned generator.

A crucial part of power system operation is on-line power system security analysis which, involving monitoring, assessment and control to decide whether the system is currently operating safely, critically or unsafe. The security of the system is evaluated for the actual state as well as for a number of simulated states which are derived from the actual state by assuming one or several line, transformer or generator outages. It is common practice to require that the system remain operational and safe for at least all single component failures or N-1 contingency.

Security Assessment (SA) is analysis performed to determine whether, and what to extend, a power system is reasonably safe from serious interference to its operation. Thus security assessment involves the evaluation of available data to estimate the relative security level of the system in its present state or some near-term future state. The form of such assessment takes will be function of what types of data are available and of what underlying formulation of the security problem has been adopted.

1.2 Significance of Study

Conventional methods in determining level of power system security involve load flow analysis method which is iterative method. At each iteration, usually a power flow solution is required, which is an iterative method itself. Therefore, the computational time is long. For security assessment, it is vital to reduce computation time, since the security level of power system need to be determined as quick as possible. Artificial Intelligent (AI) is a suitable alternative method. The use of AI especially Artificial Neural Network (ANN) will enhance the speed in calculating the security level since no calculation based on the mathematical model of the power system is required. The ANN will read the value of parameters in the power system and outputs security level. Successful implementation of ANN in determining security will provides another promising means of security assessment of power system.

1.3 Objectives

The objectives of this study are:

1. To investigate suitable neural network architecture for static security assessment.
2. To develop steady state security assessment of power system using ANN technique.
3. To verify the performance of the technique in terms of accuracy and efficiency against conventional technique, .i.e. load flow analysis.

1.4 Scope of Study

The scope and limitation of the study are as follow:

1. The steady state security assessment is limited by the thermal of transmission lines and bus voltage limit only, since these constraints are generally accepted as security criteria for most work in security assessment.
2. The developed ANN technique and conventional technique are developed on the MATLAB platform so as to obtain fair comparison between the methods.

1.5 Research Methodology

The methodology of the study is:

1. To determine ANN input output neuron from the load flow analysis using several test run of the conventional load flow analysis on the sample power system that representative of the general power system.
2. To develop ANN technique using established input output neuron criteria for the security assessment of the test system i.e. 4-bus system and IEEE Reliability Test System 24-Bus.

3. To verify the accuracy and to justify the efficiency of the ANN developed technique to the conventional security analysis to several test on the 4-bus system and 24-bus IEEE test system.

1.6 Result of the Study

A suitable ANN architecture has been proposed for implementing static security assessment. ANN for static security assessment has been implemented by MATLAB environment and the results justify advantages of ANN technique over conventional method. A well trained ANN based steady state assessment method capable of evaluating (N-1) contingency for a given power system has been tested for various test system.

1.7 Organization of the Thesis

This thesis is divided into six chapters. The first chapter is the significant of the study, followed by Chapter II, which discuss the literature review on the security assessment determination in power system. Chapter III covers the element in security assessment and the ANN configuration. Chapter IV describes about the test system and the ANN implementation methodology. Result and discussion has been placed in Chapter V. The last chapter provides the conclusion of the study and suggestion for the future work.