ABSTRACT

Contingency analysis and risk management are important tasks for the safe operation of electrical energy network. Potential harmful disturbances that occur during the steady state operation of a power system are known as contingencies. Contingency analysis is carried out by using repeated load flow solutions for each of a list of potential component failures. This process has to be executed for all the possible contingencies, and repeated every time when the system load or structure changes significantly.

Conventional methods are tedious and time consuming process, which is not desirable for real time applications. Various approximate methods have been proposed already for real time static security analysis of power systems. These methods reduce computational effort but they may not classify system contingencies accurately.

In recent years Artificial Neural Networks (ANNs) are becoming popular in power system related applications such as load forecasting, Economic dispatch, Protection, Fault diagnosis and Relay coordination. The aim of this research work is to propose an approach to implement Complex Valued Neural Network (CVNN) for solving some of the problems encountered in power system operation.

There is a great importance for load flow studies in planning, designing and future expansion of power systems. It will also help to determine the best operation of the existing system. The other power
system problems like contingency analysis, transfer capability computations, finding the optimal location of compensating devices use load flow analysis extensively, the implementation of complex neural network approach to load flow problem is taken as a beginning of the research work.

In this research work Complex Valued Neural Network (CVNN) approach is introduced for contingency evaluation, which is used for the planning and operation of a power system. Post outage voltages and line flows in complex form are estimated by implementing the proposed method. The application of proposed CVNN for contingency analysis of a 6-bus and 30 bus systems proves the effectiveness of the above method.

In a deregulated system of electricity markets there is an urgent need for adequate computations of available transfer capability (ATC) as this quantity has a direct influence on production and cost of electrical energy. With growing consumer demand, large power exchanges over long transmission lines play vital role in viable and economic operation of modern power systems.

There are various approaches for ATC calculation. One is based on DC load flow which calculates power transfer distribution factors (PTDF) to determine the transfer capability In this research the effect of reactive power is incorporated in determination of ATC using Complex Valued Neural Network approach. The effectiveness of the proposed method is demonstrated in this thesis.
It is a well known fact that transmission system power capabilities, and hence the system ATC, can be directly influenced by shunt and series compensation. This research work also proposes a method to enhance transfer capability by choosing optimal value and optimal location of TCSC. This method is compared with conventional repeated power flow (RPF) method. The capability of the method is demonstrated by using 14 bus and 30 bus system.

The ongoing power system restructuring requires an opening of unused potentials of transmission system due to environmental, right-of-way and cost problems which are major hurdles for power transmission network expansion. Flexible AC transmission systems (FACTSs) devices can be an alternative to reduce the flows in heavily loaded lines, resulting in an increased loadability, low system loss, improved stability of the network, reduced cost of production and fulfilled contractual requirement by controlling the power flows in the network. The effects of incorporating TCSC in a transmission line, load curtailment on congestion and location marginal price are demonstrated. A method to determine the optimal location of Thyristor Controlled Series Compensators (TCSCs) has been proposed in this work based on reduction of real power loss and reduction of system total reactive power losses.