**CHAPTER SIX**

**CONCLUSIONS AND SUGGESTION FOR FUTURE WORK**

* 1. **Conclusions**

An artificial neural network approach was proposed to assess the static security of IEEE 9-bus test system. Newton-Raphson power flow by using Power World Simulator’s program was applied to collect the data to be used in the training and testing of the selected neural network. The power flow was solved for different kinds of the popular disturbances and the outcomes were compared with system restrictions (the magnitudes of bus voltage and thermal limits of transmission lines) to determine the current status of the power system.

* Feed forward back propagation neural network was used to overcome the problems that associated with traditional methods in a static security assessment.
* Feed forward back propagation neural network proved the high ability by predicting the bus voltages and line flows for various operating conditions as well as the most famous probable of N-1 contingences with 2.8 \* 10 -6 the best Mean Square Error, where it reflected the correct choice of the training parameters for providing a good security to forecast the power system's operating statuses. In addition, the obtained results were a high percentage (99.25923333 %) for total Training Classification Accuracy and an acceptable percentage (90.51852 %) for total Testing Classification Accuracy. These percentages are deemed good when compared to the comparable outcomes from published works.
* The testing time required by Back Propagation Neural Network to identify power system's operating statuses and the estimated power flow was 0.013 for IEEE 9-bus test system, which is considered as a very short period because the rate of time by using Newton-Raphson technique was 0.0627. Such a short period enables the system operator to take the preventive necessary actions very quickly to prevent the electrical system from sliding into more serious cases that lead to the collapse of parts or the whole system.
* Back Propagation Neural Network detected and determined the most susceptible areas for insecure statues to warn the system operator from these weak areas. Furthermore, the rapid detection on these vulnerable areas is going to help the system operator to take the operating system back to the secure position and to avoid remaining the system at the unsafe situations that lead to the collapse or the shutdown for that system.
* Because of these results, an artificial neural network proved the reliability to assess the static security and it works well in supplying the current power system's operating status.
* This system is going to assist the trainees in the electrical stations to gain the required experience through the identification on the most popular N-1 contingency and its impact on the status of the power system. In addition, this will lead to help the engineers in maintaining the power system at a safe operating point.
* At the end of this thesis, an intelligent system was established for IEEE 9-bus system to help the system operator to operate the power system at a correct manner to keep the operating system under a secure position and avoiding the emergency situations that lead to the collapse or the blackout for that system. In addition, this system can be implemented for real time application to guarantee access a continuous supply of power to the customers without interruptions.
  1. **Suggestion for Future Work**

Future work could be expanded in these fields and directions:

* To improve the accuracy for the status of the power system, the number of the hidden layer and the neurons in each hidden layer need to be investigated further.
* Expand this technique to the large power system.
* This subject is considered an excellent start to study the dynamic security assessment as well as this technique is represented the backbone to search in the field of the power system state estimation.