CHAPTER VII
CONCLUSIONS

7.1. CONCLUSIONS

In this thesis, optimal PMU placement (OPP) and optimal cost wide area measurement system (WAMS) with maximum observability of the system has been attempted. Besides, voltage stability monitoring has been carried out in order to demonstrate the usefulness of the method.

The contribution of the present thesis can be summarized as under:

- BGSA methodology for the optimal placement of PMUs has been carried out to minimize the total number of PMUs installation at various buses such that installation cost is minimum.
- The problem has further been attempted as multi-objective in order to achieve the maximum observability.
- The cost of communication infrastructure has been taken into account along with above mentioned objectives to achieve the minimum installation cost WAMS.
- Various contingencies such as loss of a PMU, single line outage and uncertainty (single PMU outage or single line outage) have been incorporated into the OPP formulations. The presence of zero injection buses (ZIB) has been considered in all the above mentioned cases.
- The results of OPP based on BGSA are compared with the results of other prevailing methods. These results demonstrate that the proposed BGSA provide optimal number of PMUs with maximum observability of the system as compared to reported methods in the literature.
- A Voltage Stability Predictor Index (VSPI) has been devised which relies on real time phasor measurement. It has been demonstrated that the measurements obtained by installed PMUs using proposed placement method produce appropriate values of VSPI. The VSPI so obtained successfully reveals the voltage stability status of the system.

7.2. SUGGESTIONS FOR FUTURE WORK

The work can further be extended towards the following aspects:

i) The proposed BGSA algorithm can be utilized for multi-stage PMUs placement in a large power system network where utilities plan stage wise installation of PMUs.

ii) Channel limitations of PMUs can be included in the OPP formulations.

iii) Artificial Neural Network (ANN) architecture can be developed for voltage stability assessment. The large real time data available from the PMUs can be utilized for training the ANN.