CHAPTER VI

CONCLUSION

An attempt is made in this thesis for contribution in potential thrust areas of research on "congestion management with social welfare" in multi-transaction environment. Power losses due to transactions and their costs allocations in the social welfare is also one of the contributions of the work. The present work focuses on optimal rescheduling of active powers based methodology.

Power system operation becomes a changeling task for the power utilities due to inadequate transmission capabilities and multi-transaction setups in power market. The inadequate capability in the system creates the problem of congestion. Thus, the social welfare maximization with congestion management becomes an important issue among operators. In such cases, the question of managing the undisputable distribution of welfares to all the transactions during congestion becomes a key issue in the electricity business. It reflects that it is very hard task to manage the operations of deregulated power system when there is a lack of adequate capacity. In the present thesis the centralized optimal power flow (COPF) and decentralized optimal power flow (DOPF) based decision support have been used to obtain the solution for this problem. The results of this work provide an adequate benefit of DOPF over COPF. The DOPF provide good solutions for social welfare maximization and manage the congestion without affecting the independency of transactions in multi-transaction system.

This research work also dealt with the issue of transmission loss allocation in multi-transaction system. Mostly, the power system operations are centrally governed and the losses and its costs are centrally allocated on the slack bus. The prices of losses are based on purely ad-hoc basis. The ad-hoc basis loss allocation in power system is highly objectionable for a healthy and competitive power market. After deregulation, various power players are entering into the power market and formulating the multi-transactional structure in the system. The loss allocation becomes a new challenging task in

the power market operations. Therefore, this work incorporates the individual transaction loss and their cost in the problem formulation of DOPF. This formulation provides an effective solution for evaluation of actual welfares of transactions and the social welfare of the system.

The optimization technique plays an important role in deciding the operational strategy of the power systems. The selection of an efficient optimization technique for problem objective is also one of the essential requirements. In the present work, the interior point (IP) and particle swarm optimization (PSO) are used to solve the problem objective with COPF and DOPF formulations. Additionally, a hybrid PSO technique is also proposed in this work. This technique is known as IP initialized PSO (IP-PSO). The results of IP-PSO with COPF and DOPF show the improved performance over IP and PSO. The proposed technique is made by utilizing the useful properties of IP and PSO.

The author's contributions and achievements in the present work are summarized as follows:

- The optimal rescheduling of active powers of generators and demands of consumers are used for alleviating the congestion from the system in the present work.
- The congestion in the system is identified by PTDF calculations.
- Following two formulations have been suggested for rescheduling:
  - COPF based rescheduling of active powers.
  - DOPF based rescheduling of active powers using optimal resources allocation (ORA) method.
- Resources allocation weight matrix (RAWM) is used to obtain the power transfer in a line due to a transaction in multi-transaction system in DOPF problem formulation.
- The fair competition and undisputable distribution of costs of losses in multi-transaction system have been ensured by proper distribution of cost of losses on various transactions.
- The solution of COPF and DOPF optimization problems are obtained by following methods:
  - Interior point optimization based conventional method.
  - Particle swarm optimization method.

- A new proposed hybrid PSO method of IP-PSO.

- Two test systems with multi-transaction set-ups are considered to test the performance of developed objectives. These test systems are modified IEEE-30 bus and modified IEEE-118 bus systems.
- The effectiveness of the COPF and DOPF method is demonstrated though three case studies on modified IEEE-30 bus and modified IEEE-118 bus systems.
- The results of developed methods are compared with the results of reported work in literature.
- The results of IP-PSO are compared with results of IP and PSO. These results demonstrate that the proposed IP-PSO provides improved social welfare as compared to reported work in literature. The computation time for IP-PSO is less as compared to PSO and the reported work in literature.

SUGGESTIONS FOR FUTURE WORK

The work can be extended on following lines:

i. The proposed work can be utilized for on-line steady-state and dynamic security assessments in multi-transaction power systems.
ii. This work includes only the real power rescheduling and real power flows in the system, assuming voltages are constant. Therefore, the extension could include the reactive power scheduling and voltage variations due to reactive power flow.
iii. The utilization of obtained social welfare in the system is also a subject of future research.
iv. The role of FACTs devices in multi-transaction system for congestion management can be considered as a future work base on present study.