Chapter 8

Conclusions and Future Scope

8.1 Conclusions

- Three numerical power flow algorithms, CINR, LMPF, and RK4PF, are proposed in Chapter-2. These algorithms have been validated on several ill-conditioned test systems. Comparative analysis reveals that the proposed algorithms outperform the other state-of-the-art algorithms viz. TCIM, iTCIM, and BFS in terms of rate of convergence and robustness.

- In Chapter-3, an unconstrained optimization algorithm, Spherical Search, is proposed. This algorithm is used to calculate the initial solution for the load flow algorithms. From the extensive analysis, it has been established that the proposed approach improves the performance of the load flow algorithm for the ill-conditioned and heavily loaded systems in terms of convergence and robustness.

- In Chapter-3, a new formulation of the power flow problem as a non-convex and non-linear constrained optimization problem is proposed to compute the steady-state condition of the system at critical loading conditions. A constrained optimization algorithm, Butterfly Constrained Optimizer (BCO), is proposed to solve this problem. Comparative analysis established that the BCO successfully evaluates continuation power solutions.

- In Chapter-4, nested-iterative approaches, NBFS and CINR, are proposed to solve the power flow problem of a droop-based islanded microgrid. The loop based approach comprises of updating the voltage and system frequency of the angle reference bus. The algorithms have been implemented on several test systems to establish the effectiveness of algorithms. Further, the comparative analysis shows that proposed algorithms has superior convergence in comparison to state-of-the-art algorithms viz. MNR, NTR, DBFS, MBFS, and PSCAD.

- In Chapter-5, two novels constrained optimization algorithms, ϵDE-GN and υMAESbm, are proposed to solve the power flow problem of droop-controlled islanded microgrids. Further, the power flow problem is formulated as a constrained optimization problem. The proposed algorithm is applied on balanced as well as unbalanced test systems. The outcomes demonstrate that the proposed algorithms perform better than other state-of-the-art algorithms viz. PSO, NTR, and GA.

- In Chapter-6, the phase balancing and loss minimization of single-phase distributed generations has been addressed. This problem is formulated as a mixed-integer nonlinear unconstrained optimization problems. Further, a new method, EBOwithCMAR, has been proposed and has used with CINR to solve this problem. In this approach, CINR is used to calculate objective function at each solution. Four different objectives are considered in this work. From comparative analysis, it has been established that EBOwithCMAR with CINR is an effective algorithm to solve loss minimization and phase balancing problem.

- In Chapter-7, for solving the optimal power flow problem of droop-controlled islanded microgrids, a new optimization algorithm, ESHADE, has been proposed. The minimization of power losses is considered as an objective function in optimal power flow. Proposed formulation is validated on the several test systems and results show that active and reactive power losses are reduced. However, the voltage profile is slightly degraded to adjust the new settings of droop controllers.

8.2 Future Scope

The proposed algorithms can be applied for the planning and analyzing distribution systems. Power flow algorithms can be extended to investigate their applicability to the voltage-stability of the systems. Optimization algorithms can be utilized for economic dispatch, centralized and decentralized coordination of plug-in vehicles, optimal sizing, and siting of the battery storage system problems of distribution systems.