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Multi-objective optimal reactive power flow using Mixed Integer Non-Linear Programming

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Abstract:

The measure of Reactive power optimization of main power network mainly considers on-load tap changer, the optimal capacity of the capacitor, the voltage of generator under the steady load. In This paper, a multi-objective optimization methodology to the Optimal Reactive Power Flow (ORPF) problem is proposed in which the ε-constrained approach is implemented for the Multi-objective Mathematical Programming (MMP) formulation. The objective functions of the proposed model include optimize the total fuel cost, the active power losses, and the system load ability. Since the control variables include discrete variables (var sources and transformer tap ratios), the ORPF is inherently a mixed-integer nonlinear programming (MINLP) problem. The optimum tap settings of transformers are directly determined in terms of the admittance matrix of the network since the admittance matrix is constructed in the optimization framework as additional equality constraints. To show the effectiveness of proposed method the results are compared with single-objective, two-objectives and three-objectives. Finally, the method has been implemented in GAMS and solved using DICOPT solver to obtain optimal solutions. In this research, for selection of the best compromising answer among the Pareto optimal solutions has been designed a fuzzy decision-maker tool. The algorithm is tested on standard IEEE 14- bus test system. Simulation results show that the proposed algorithm is able to control reactive power flow effectively and optimize the selected objective functions.

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Keywords: Non-Linear Programming, OA/ER/AP algorithm, Reactive power flow