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Optimal Reactive Power Flow and Economic Power Dispatch in Multiterminal AC-DC Systems based on Genetic Algorithm

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Abstract- Optimal reactive power flow and economic power dispatch is very important in power systems. Optimal reactive power flow provides minimum active power loss and economic power dispatch provides minimum active power generation cost in power systems. This study presents a novel approach for both the optimal reactive power flow and economic power dispatch in multi-terminal AC-DC systems. The presented approach in the study considers the system constraints for all of the control and state variables of both AC and DC systems in the optimization. Sequential method is chosen for AC-DC power flow algorithm in the study and it is performed by getting back and forward between AC and DC power flow algorithms. Optimization for obtaining minimum active power loss and minimum generation cost are performed by genetic algorithm (GA). The proposed study is the first one that uses GA for optimal reactive power flow and economic power dispatch in multi-terminal AC-DC systems in the literature. The presented approach is tested on the modified IEEE 14-bus AC-DC test system. The presented approach is applied to the test system 100 times with different initial conditions to show its accuracy and efficiency. GA achieves to reach the same global optimum point closely without getting stuck to local minima for each case. The proposed approach is also compared with the traditional numerical optimization methods by applying them to the same test system. The proposed approach does not have any problem getting stuck to local minima where the compared methods fall to this problem. On the other hand, the obtained results prove that the proposed optimization technique based on GA is more reliable and efficient than the compared methods to achieve the global optimum while satisfying the system constraints.

Keywords- optimal reactive power flow, economic power dispatch, AC-DC, multi-terminal, genetic algorithm