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Genetic Algorithm Solution for Optimal Active Power Flow in Multiterminal HVDC Systems

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Abstract- In this paper, a different approach for the optimal active power flow solution in multi-terminal HVDC systems to minimize total active power generation cost is proposed. System constraints for all of the control and state variables of both AC and DC systems are also considered in the optimization study. In the proposed approach, AC-DC power flow is performed by sequential method. In the sequential method, AC and DC power flow algorithms are performed separately through getting back and forward between AC and DC power flow algorithms. Minimization of generator fuel cost is obtained through genetic algorithm (GA) also including the system constraints in the GA objective function. The proposed approach is the first one that uses GA for optimal active power flow solution in multi-terminal HVDC systems in the literature. The approach is tested on the modified IEEE 14-bus AC-DC test system and applied to the test system 100 times with different initial conditions to prove the accuracy of the proposed approach. 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. The comparative results demonstrate that the proposed optimization method based on GA is more reliable and efficient to achieve the global optimum while satisfying the system constraints without getting stuck to local minima than the compared methods.

Keywords- optimal active power flow, HVDC, multi-terminal, genetic algorithm