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Optimal Active Power Flow Solution in Multi-terminal AC-DC Systems through Artificial Bee Colony Algorithm

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Abstract- This paper presents a different approach for the optimal active power flow solution in multi-terminal AC-DC systems to minimize total active power generation cost. System constraints for all of the control and state variables of both AC and DC systems are also considered in the optimization process. In the proposed approach, AC-DC power flow is solved by sequential method that is based on getting back and forward between AC and DC power flow algorithms. Optimization for obtaining minimum generator fuel cost is performed through artificial bee colony (ABC) algorithm. System constraints are included into the objective function that is minimized in ABC algorithm. This paper is the first one that uses ABC algorithm for optimal active power flow solution in multi-terminal AC-DC systems in the literature. The proposed approach is tested on the modified IEEE 14-bus AC-DC test system. To prove the accuracy of the proposed approach, it is applied to the test system 100 times with different initial conditions. For each case, ABC algorithm succeeds to reach the same global optimum point closely without getting stuck to local minima. The proposed approach is compared with the numerical optimization techniques on the same test system. The results show that the proposed ABC algorithm based optimization technique is reliable and efficient to achieve the global optimum while satisfying the system constraints and it is better than the compared traditional numerical methods.

Keywords: optimal active power flow, AC-DC, multi-terminal, artificial bee colony algorithm