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Economic Power Flow and Active Power Loss Minimization in Multiterminal HVDC Systems using Artificial Bee Colony Algorithm

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Abstract- Optimal operation of the power systems is very important. In this paper, a new approach for both the economic active power flow and active power loss minimization in multi-terminal HVDC systems is proposed. In the proposed optimization approach, system constraints for all of the control and state variables of both AC and DC systems are considered in the optimization process. AC-DC power flow is performed by sequential method by getting back and forward between AC and DC power flow algorithms. In the study, obtaining minimum generator fuel cost and minimum active power loss are aimed and optimized by artificial bee colony (ABC) algorithm. The presented study is the first one that uses ABC algorithm for the aimed optimization in multi-terminal HVDC systems in the literature. The proposed approach is applied to the modified IEEE 14-bus AC-DC test system to test the study. The approach is tested on the test system 100 times with different initial conditions to show its accuracy and efficiency. ABC algorithm achieves to reach the same global optimum point closely without getting stuck to local minima for each case. The approach is compared with the well-known traditional numerical optimization methods on the same test system. The obtained comparative results prove that the proposed optimization technique based on ABC algorithm is reliable and efficient to achieve the global optimum while satisfying the system constraints where the compared methods obtain worse results and getting stuck to local minima problems.

Keywords- economic power flow, active power loss, HVDC, multi-terminal, artificial bee colony algorithm