Title:	Multi-Objective-Based Charging and Discharging Coordination of Plug-in Electric Vehicle Integrating Capacitor and OLTC
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Abstract:

The integration of plug-in electric vehicles (PEVs) in residential distribution networks demands a significant amount of electrical load where random and uncoordinated charging affects the quality and performance of the distribution network. Random and uncoordinated charging may increase the peak demand and can increase stress on critical network assets such as line, transformer, and switching devices. Moreover, the charging of PEVs in a low network reduces the voltage of the system below the lower limit. On the other hand, using PEVs as storage in the V2G mode can improve the network condition. Therefore, it is critical to properly manage the charging and discharging operation of PEVs. This paper proposes a multi-objective-based charging and discharging coordination of PEVs with the operation of the capacitor and on-load tap changer (OLTC). With the proposed strategy, the distribution network is operated safely, and charging is ensured for all PEVs connected to the network. The main consideration of this research is to reduce the daily power loss, operational cost, and voltage deviation of the system. The metaheuristic optimization binary firefly algorithm (BFA) has been applied to coordinate PEV charging and discharging as well as capacitor and OLTC operation in the system. A modified IEEE 31 bus 23 kV distribution system is used to implement the proposed strategy. From the obtained results, it is found that the combined PEV charging and discharging coordination with capacitor and OLTC operation reduces the power loss and cost by 34.16% and 12.68%, respectively, with respect to uncoordinated charging and enhances the voltage condition of the network.