Title:	Multi-Objective Optimal Placement of EVCS and DGs in Distribution Systems Using Flower Pollination Algorithm under Varying Load Scenarios
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Abstract:
The increasing adoption of electric vehicles (EVs) and the shift towards decentralized power generation have driven significant changes in power distribution networks, necessitating optimized infrastructure planning for stability and efficiency. This paper presents a methodology for the optimal placement of Electric Vehicle Charging Stations (EVCS) and Distributed Generators (DGs) in distribution networks, using the Flower Pollination Algorithm (FPA) to minimize power losses and improve voltage stability across varied load conditions (100%, 125%, and 150%). The proposed multi-objective optimization approach combines biotic and abiotic pollination mechanisms to balance exploration and exploitation within the solution space, adapting to different load profiles by minimizing active and reactive power losses and maintaining voltage limits. Experimental results demonstrate the combined EVCS-DG configuration achieved active power loss reductions of 58.59%, 71.05%, and 79.80%, and reactive power loss reductions of 46.38%, 61.40%, and 71.92% for 100%, 125%, and 150% loads, respectively. Voltage stability was improved, with minimum bus voltages reaching 0.9661 p.u., 0.9616 p.u., and 0.9646 p.u., while convergence times ranged from 102.64 to 123.75 seconds. This study offers a comparative analysis with existing EVCS and DG placement methods, demonstrating enhanced efficiency and network stability across all scenarios.

Keywords:
Optimal EVCS and DG placement, Flower Pollination Algorithm, distribution network stability, power loss reduction, voltage stability, load variation analysis, multiobjective optimization