Integrating Firefly and Crow Algorithms for the Resilient Sizing and Siting of Renewable Distributed Generation Systems under Faulty Scenarios	
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Abstract: This study aimed to optimize the sizing and allocation of renewable distributed generation (RDG) systems, with a focus on renewable sources, under N-1 faulty line conditions. The IEEE 30-bus power system benchmark served as a case study for us to analyze and enhance the reliability and quality of the power system in the presence of faults. The firefly algorithm (FFA) combined with the crow search (CS) optimizer was used to achieve optimal RDG sizing and allocation through solving the optimal power flow (OPF) under the most severe N-1 faulty line. The reason for hybridization lies in leveraging the global search capabilities of the CS optimizer for the sizing and allocation of RDGs and the local search proficiency of the FFA for OPF. Two severe N-1 faulty conditions—F27-29 and F27-30—were separately applied to the IEEE 30-bus distribution system. The most severe N-1 faulty line of these two faulty lines was F27-30, based on a severity ranking index including both the voltage deviation index and the overloading index. Three candidate buses, namely 27, 29, and 30, were considered in the optimization process. Our methodology incorporated techno-economic multi-objectives, encompassing overall costs, power losses, and voltage deviation. The optimizer can eliminate the impractical buses/solutions automatically while remaining the practical one. The results revealed that optimal RDG allocation at bus 30 effectively alleviated line overloading, ensuring compliance with the line flow limit, reducing costs, and enhancing voltage profiles, thereby improving system performance under N-1 faulty conditions compared to the equivalent case without RDGs.

هـ-خوجه