Mehdi Izadi, Seyed Hossein Hosseinian, Shahab Dehghan, Ahmad Fakharian and Nima Amjady, 2023, Resiliency-oriented operation of distribution networks under unexpected wildfires using Multi-Horizon Information-Gap decision theory, *Applied Energy,* Available online 18 January 2023, 120536.

Highlights

- Propose a multi-horizon IGDT-based model for the resilient operation of a distribution network against wildfires.
- Utilize a proficient multi-objective optimization method to solve the multi-horizon IGDT-based model.
- Obtain a set of evenly distributed Pareto optimal solutions for a specific conservatism level.
- Find the best solution among a set of Pareto optimal solutions using a posteriori out-of-sample analysis.
- Introduce a novel resilience index to find the optimum crisis management budget.

Abstract Extreme events may trigger cascading outages of different components in power systems and cause a substantial loss of load. Forest wildfires, as a common type of extreme events, may damage transmission/distribution lines across the forest and disconnect a large number of consumers from the electric network. Hence, this paper presents a robust scheduling model based on the notion of information-gap decision theory (IGDT) to enhance the resilience of a distribution network exposed to wildfires. Since the thermal rating of a transmission/distribution line is a function of its temperature and current, it is assumed that the tie-line connecting the distribution network to the main grid is equipped with a dynamic thermal rating (DTR) system aiming at accurately evaluating the impact of a wildfire on the ampacity of the tie-line. The proposed approach as a multi-horizon IGDT-based optimization problem finds a robust operation plan protected against the uncertainty of wind power, solar power, load, and ampacity of tie-lines under a specific uncertainty budget (UB). Since all uncertain parameters compete to maximize their robust regions under a specific uncertainty budget, the proposed multi-horizon IGDT-based model is solved by the augmented normalized normal constraint (ANNC) method as an effective multi-objective optimization approach. Moreover, a posteriori out-of-sample analysis is used to find (i) the best solution among the set of Pareto optimal solutions obtained from the ANNC method given a specific uncertainty budget, and (ii) the best resiliency level by varying the uncertainty budget and finding the optimal uncertainty budget. The proposed approach is tested on a 33-bus distribution network under different circumstances. The case study under different conditions verifies the effectiveness of the proposed operation

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planning model to enhance the resilience of a distribution network under a close wildfire.

Keywords Distribution Network Resilient Operation (DNRO), Dynamic Thermal Rating (DTR), Information Gap-Decision Theory (IGDT), Wildfire.