

Zhisheng Xiong, Bo Zeng, Peter Palensky and Pedro P. Vergara, 2024, Two-stage robust optimal operation of distribution networks using confidence level based distributionally information gap decision, Preprint, <https://arxiv.org/abs/2411.10166>

**Abstract** This paper presents a confidence level-based distributionally information gap decision theory (CL-DIGDT) framework for the two-stage robust optimal operation of distribution networks, aiming at deriving an optimal operational scheme capable of addressing uncertainties related to renewable energy and load demands. Building on conventional IGDT, the proposed framework utilizes the confidence level to capture the asymmetric characteristics of uncertainties and maximize the risk-averse capability of the solution in a probabilistic manner. To account for the probabilistic consideration, the imprecise Dirichlet model is employed to construct the ambiguity sets of uncertainties, reducing reliance on precise probability distributions. Consequently, a two-stage robust optimal operation model for distribution networks using CL-DIGDT is developed. An iterative method is proposed to solve the model and determine the upper and lower bounds of the objective function. Case study demonstrates that the proposed approach yields a more robust and statistically optimized solution with required accuracy compared to existing method, contributing to a reduction in first-stage cost by 0.84%, second-stage average cost by 6.7%, and significantly increasing the reliability of the solution by 8%.

**Keywords** Robust optimization, information gap decision theory, probability, ambiguity set, distribution networks.