

Jisong Zhu; Jiang Dai; Yuhui Song; Shijin Tian; Nianjie Tian; Zhaoxia Jing, 2025, Design of reliability unit commitment mechanism based on information gap theory, 2025 IEEE PES Innovative Smart Grid Technologies, 07–09 November 2025, Guangzhou, China.

Abstract With the gradual increase in renewable energy penetration, a deterministic reliability unit commitment (RUC) approach becomes less effective in maintaining sufficient intraday available capacity when renewable output fluctuates significantly. To address this challenge, this paper improves the existing RUC clearing model using information gap decision theory (IGDT) and proposes a complete clearing framework and model. Simulation results on the IEEE 118-bus system demonstrate that the IGDT-based RUC mechanism effectively achieves market clearing by trading off a small degree of economic optimality to enhance computational tractability. The proposed model exhibits strong applicability and high computational efficiency, making it well-suited for large-scale systems with high renewable integration.

Keywords reliability unit commitment, information gap decision theory, uncertainty optimization, clearing, mechanism design.