Tianyang Zhao, Jianhua Zhang, and Peng Wang, 2016, Flexible active distribution system management considering interaction with transmission networks using information-gap decision theory, Canadian Society for Electrical Engineering (CSEE) *Journal of Power and Energy Systems,* vol. 2, no. 4, pp.76–86.

Abstract In this paper, a flexible management method is proposed for an active distribution system (ADS) with distributed energy resources (DERs) integrated, where DERs can provide spinning reserves to transmission networks. This method, based on the information-gap decision-making theory (IGDT) theory, could be of use to the ADS operator (ADSO) from either the opportunistic or robust perspective when reserve is called by the independent system operator (ISO). Two IGDT uncertainty models are employed to depict the characteristics of reserve uncertainty in centralized and decentralized control frameworks. The reactive power of each DER is managed by the ADSO in the immunity functions, which are reformulated as bi-level biobjective optimization problems. A hybrid multi-objective differential evolutional algorithm (MODE) is proposed to solve the optimization problems. The relationship between the uncertainty levels and robust/opportunistic limits is revealed by the Pareto fronts obtained by MODE. Effectiveness of the proposed method is demonstrated based on simulation results of a 33-bus and 123- bus test system.

Keywords Active distribution system, bi-level multi-objective optimization, information-gap decision-making theory, reserve uncertainty.