IEEE Transactions on Power Systems, vol.39, no.1, pp.273-286, January, 2024.

Computational performance enhancement strategies for risk-averse two-stage stochastic generation and transmission network expansion planning

A. García Cerezo; L. Baringo Morales; R. Garcia Bertrand

Abstract-

This paper proposes a new acceleration technique and a representative day aggregation procedure for the risk-averse two-stage stochastic generation and transmission network expansion planning problem, in which the conditional value-at-risk is used. We use a finite set of scenarios to model uncertainty in the peak demand level of loads, along with the capacity and marginal production cost of generating units. Moreover, we use representative days to model the operational variability of the electrical demand and renewable generation. The combination of scenarios and representative days involves many variables and constraints, which may lead to computationally intractable problems. Therefore, we propose a new relaxed version of the constraint generation-based algorithm that reduces the computational time of the problem. We additionally present a two-stage aggregation procedure that combines the modified maximum dissimilarity algorithm and the priority chronological time-period clustering in order to reduce the resolution of the representative days and to pay attention to extreme conditions. The numerical results of modified versions of the IEEE 24-bus Reliability Test System and the IEEE 118-bus Test System show reductions in the computational time of more than 89% for the relaxed constraint generation-based algorithm, and of more than 94% for the two-stage aggregation procedure.

Index Terms- Constraint generation-based algorithm, generation and transmission network expansion planning, operational variability, representative days, risk aversion, two-stage stochastic programming, uncertainty.

Citation:
Baringo, L.; Garcia-Bertrand, R.; García-Cerezo, A. "Computational performance

enhancement strategies for risk-averse two-stage stochastic generation and transmission network expansion planning", IEEE Transactions on Power Systems, vol.39, no.1, pp.273-286, January, 2024.