

Security constrained unit commitment using line outage distribution factors

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Abstract— Security-constrained unit commitment (SCUC) problem is one of the necessary tools for system operators to make operational planning and real-time operation. The internalization of transmission-network and security constraints (e.g. N-1 criterion) could lead to different decisions in the generation dispatch. However, the computational burden of this problem is challenging mainly due to its inherent large problem size. Therefore, this paper proposes an N-1 security constrained formulation based on the Line Outage Distribution Factors (LODF) instead of the one based on Injection Sensitivity Factors (ISF). This formulation is at the same time more compact than analogous formulations for contingency constraints; hence, it presents a lower computational burden. The computational efficiency of the proposed formulation is shown by solving the SCUC of the IEEE 118 bus system with LODF and ISF. Additionally, an iterative methodology for filtering the active N-1 congestion constraints is detailed, and its implementation for large-scale systems is described. The results show that the proposed filter reduces the computational time by approximately 70% in comparison to the complete formulation of N-1 constraints in SCUC.

Index Terms— mixed-integer linear programming (MIP), security constrained unit commitment (SCUC), line outage distribution factors (LODF), N-1 criterion.

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Citation:

Tejada, D.A.; Sánchez, P.; Ramos, A.; "Security constrained unit commitment using line outage distribution factors", IEEE Transactions on Power Systems, vol.33, no.1, pp.329-337, January, 2018.