Second-Order Conic Programming Model for Load Restoration Considering Uncertainty of Load Increment based on Information Gap Decision Theory

Load restoration is an important issue for power system restoration after a blackout. A second order conic programming (SOCP) model is proposed based on the information gap decision theory (IGDT) to maximize load pickup considering the uncertainty of load increment. Because distribution functions of load increment are difficult to obtain, the optimization of load pickup is transformed to maximize the fluctuation range of load increment by the IGDT. The derived optimal fluctuation range can ensure that the reenergized system is secure, and the amount of load pickup is always better than the specified expectation. Moreover, because the optimization model of the fluctuation range is a mixed-integer nonlinear model which is challenging to solve accurately and efficiently, the nonlinear model is transformed into a SOCP model that can be efficiently solved using CPLEX. The efficiency of the IGDT-based SOCP model is validated using the New England (10-machine 39-bus) system. The simulation results show that the derived load pickup shows expected robustness with respect to the load increment uncertainty.

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