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Formulation and Solution of Contingency Constrained ACOPF Problem with Pyomo

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ABSTRACT

Power grids scattered around the world bring great importance to society as they are challenged to provide economically efficient and reliable power market. With consideration of possible system contingency, which refers to multi-scenario optimization where each scenario considers an individual transmission element failure, the determination of optimal generators' set points in the transmission network is becoming even more essential and challenging. A problem formulation is developed to solve the optimal allocation and minimize the total operating cost for the nominal case while including a large number of contingency scenarios. To achieve that goal, traditional ACOPF (AC optimal power flow model) must be well formulated first within optimization package called Pyomo, a Python-based general optimization modeling language, to confirm that good model of transmission networks has been obtained. One way is to compare the results from Pyomo and Matpower, a specifically built Matlab simulation tool to solve ACOPF problems. Then, the model must be modified to consider multiple possible contingencies that may occur to the transmission network. We observe that the solutions of these contingency-based AC optimal power flow problems provide more flexibility to optimal generator costs that are resilient to system failure, compared to normal ACOPF problems with no broken transmission element. For a larger scale implementation, one obvious issue that still needs to be addressed is to include parallel computation capabilities to quickly solve more complicated multi-scenario optimization problems.

KEYWORDS

Power grid, ACOPF, contingency-constrained, stochastic optimization, Pyomo

REFERENCES

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