Abstract

In this thesis, optimal placement of phasor measurement units (PMUs) for complete system observability is accomplished. The ultimate goal is to find the minimum number of PMUs and their corresponding locations so that the state estimation could be performed with measured phasor data. For assessment of network observability, topological approach is considered and by extending of its rules, the efficiency of network analysis is increased. Particle swarm optimization is used as a tool for deriving the minimum number of required PMUs for full network observability.

Possibility of PMU loss or changing the network topology is also highlighted in the thesis. The output configuration has got some redundancy so that the system is still observable after the failure of any PMUs or outage of any branches.

For solving each of the aforementioned problems, an algorithm has been proposed and the simulation results for some IEEE test systems are presented. Roughly, it can be said that for complete system observability in normal conditions, it is required to install PMU on 25 percent of total system buses. Also, for contingency situations, it's necessary to install PMU on about 50 percent of total system buses.

Keywords: power system, phasor measurement unit, optimal placement, state estimation, observability analysis, particle swarm optimization.