

Unbalanced Distribution Optimal Power Flow to Minimize Losses with Distributed Photovoltaic Plants

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Abstract : Electric power systems are likely to operate with minimum losses and voltage meeting international standards. This is made possible generally by control actions provide by automatic voltage regulators, capacitors and transformers with on-load tap changer (OLTC). With the development of photovoltaic (PV) systems technology, their integration on distribution networks has increased over the last years to the extent of replacing the above mentioned techniques. The conventional analysis and simulation tools used for electrical networks are no longer able to take into account control actions necessary for studying distributed PV generation impact. This paper presents an unbalanced optimal power flow (OPF) model that minimizes losses with association of active power generation and reactive power control of single-phase and three-phase PV systems. Reactive power can be generated or absorbed using the available capacity and the adjustable power factor of the inverter. The unbalance OPF is formulated by current balance equations and solved by primal-dual interior point method. Several simulation cases have been carried out varying the size and location of PV systems and the results show a detailed view of the impact of PV distributed generation on distribution systems.

Keywords : distribution system, loss, photovoltaic generation, primal-dual interior point method

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