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OPTIMAL PMU PLACEMENT IN SMART GRID FOR FULL SYSTEM OBSERVABILITY

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The fundamental changes of the power system due to the increasing number of renewable energy sources, small-scale photovoltaic, feeding into networks on various voltage levels, requires radically new control schemes that strongly rely on the availability of adequate monitoring infrastructure [1], [2]. Phasor measurement units (PMUs) are crucial tools for the monitoring of the transmission networks and are likely be used in the future in medium and low voltage distribution grids as well. A deployment of the PMUs could enable a realizing a wide range of control objectives required for future power system both in Russia and in Europe.

During the ELECTRA Research Exchange call at the Smart Grid Research Centre, a new method for the optimal phasor measurement units (PMUs) placement problem when considering the topological observability of the power system is developed [3]. Different from other problem formulations, decision variables are associated with phasor measurements, but not with PMUs. This approach makes it easy to take into account the availability of PMU measuring channels, effect of zero-injection bus, possible system contingencies like single PMU or branch loss, as well as gross error occurrence, and offers flexibility in specifying the objective function. The method is appropriate for the PMUs that have the limited number of measuring channels and especially for the devices with the configurable number of channels, by which the Smart Grid Research Centre is equipped.

Numerical results on IEEE standard test systems are presented and reveal the existence of the PMU placements which ensure topological observability, but fail to meet numerical observability. Investigation has shown that such solutions can occur for certain combinations of the zero-injection buses and branches with an equal conductivity.

Figure 1. In front of Riga Hydro Power Plant, Latvia

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