

## Selection of Wind Farms to Add Virtual Inertia Control to Assist the Power System Frequency Regulation

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**Abstract :** Due to the randomness and uncertainty of wind energy, modern power systems integrating large-scale wind generation will be significantly impacted in terms of system performance and technical challenges. System inertia with high wind penetration is decreasing when conventional thermal generators are gradually replaced by wind turbines, which do not naturally contribute to inertia response. The power imbalance caused by wind power or demand fluctuations leads to the instability of system frequency. Accordingly, the need to attach the supplementary virtual inertia control to wind farms (WFs) strongly arises. When multi-wind farms are connected to the grid simultaneously, the selection of which critical WFs to install the virtual inertia control is greatly important to enhance the stability of system frequency. By building the small signal model of wind power systems considering frequency regulation, the installation locations are identified by the geometric measures of the mode observability of WFs. In addition, this paper takes the impacts of grid topology and selection of feedback control signals into consideration. Finally, simulations are conducted on a multi-wind farms power system and the results demonstrate that the designed virtual inertia control method can effectively assist the frequency regulation.

**Keywords :** frequency regulation, virtual inertia control, installation locations, observability, wind farms

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