Power oscillation damping capabilities of wind power plant with full converter wind turbines considering its distributed and modular characteristics - DTU Orbit (07/08/2016)

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Wind power plants (WPP) are for power system stability studies often represented with aggregated models where several wind turbines (WT) are aggregated into a single up-scaled model. The advantage is a reduction in the model complexity and the computational time, and for a number of study types the accuracy of the results has been found acceptable. A large WPP is, however, both modular and distributed over a large geographical area, and feasibility of aggregating the WTs, thus, have to be reassessed when new applications are introduced for WPPs. Here, the power oscillation damping capabilities are investigated for a WPP, which includes the full layout of the collector grid and where the WTs are represented individually. With this approach, the influence of the WT control in terms of impact on oscillatory modes is assessed for the WTs individually. The initial results encourage that park level control is possible. Time domain simulations support that each WT contribute to a common WPP response. Park level active and reactive power-based power oscillation damping controllers (POD) are designed and the positive damping contribution is demonstrated. Keeping the POD designs unchanged, the impact of WPP aggregation is investigated and it is shown that the level of WPP aggregation only has limited impact on the resulting modal damping. The study is based on a non-linear, dynamic model of the 3.6 MW Siemens Wind Power WT.

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