Framework of Multi-objective Wind Farm Controller Applicable to Real Wind Farms

Optimal wind farm control can mitigate adverse wake effects that can potentially cause up to 40% power loss and 80% increased fatigue loads in wind farms. The aim of this work is to outline a methodological framework of an optimal wind farm controller, which provides improved solutions to critical areas of optimal wind farm control research. The basis of this framework is a review of optimal wind farm control methodologies, which is presented first. It is observed that there is, at present, mainly a need for more advanced wind farm operation models. Thereafter the framework of a multi-objective optimal wind farm controller is outlined with the following key characteristics.

Available control objectives are (i) to maximize the total wind farm power output or (ii) to follow a specified power reference for the wind farm's total power output while reducing the fatigue loads of the wind turbines in the wind farm. The controller design provides improved solutions for the modelling of wind farm aerodynamics and turbine operation, that is the PossPOW algorithm and a HAWC2-based turbine model, respectively. Moreover, all components of the framework are designed as to enable the applicability of the controller to real wind farms.

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