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LIDAR-assisted collective pitch control shows promising results for load reduction in the full load operating region of horizontal axis wind turbines (WT). Utilizing LIDARs in WT control can be approached in different ways; One method is to design the WT controller from ground up based on the LIDAR measurements. Nevertheless, to make the LIDAR-assisted controller easily implementable on existing wind turbines, one can design a controller that is added to the original and existing WT controller. This add-on solution makes it easier to prove the applicability and performance of the LIDAR-assisted WT control and opens the market of retrofitting existing wind turbines with the new technology. In this paper, we suggest a model predictive controller (MPC) that is added to the basic gain scheduled PI controller of a WT to enhance the performance of the closed loop system using LIDAR measurements. The performance of the MPC controller is compared against two controllers. The controllers are 1) a gain scheduled PI controller and 2) a controller with the same feedback as controller no. 1 and an added feed-forward loop (FF+PI controller). Simulations are used to compare their performances. The simulation scenarios include the extreme operating gust and normal power production using stochastic wind field in the full load region. The results show superior performance compared to the PI controller and a performance marginally better compared to the FF+PI controller. The reason for a better performance against the PI controller is that the MPC controller employs the LIDAR wind speed measurements to predict and compensate future disturbances. The MPC controller is designed based on the closed loop model of the wind turbine including the pitch actuator and therefore an appropriate pitch signal is calculated, while the FF+PI controller employs filter and delay compensation to take the actuator dynamics into account.

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