Load Reduction of Wind Turbines Using Receding Horizon Control

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Large scale wind turbines are lightly damped mechanical structures driven by wind that is constantly fluctuating. In this paper, we address the design of a model-based receding horizon control scheme to reduce the structural loads in the transmission system and the tower, as well as provide constant (or at least smooth) power generation. Our controller incorporates two optimization problems: one to predict or estimate mean wind speed, given LIDAR data, and the other to carry out receding horizon control to choose the control inputs. The method is verified against an existing wind turbine control system, and shows reductions in both extreme loads and power fluctuations by 80% and 90% respectively, when compared to a conventional controller.