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Wind Turbine Gust Prediction Using Remote Sensing Data PAUL TOWERS, BRYN JONES, Department of Automatic Control and Systems Engineering, University of Sheffield — Offshore wind energy is a growing energy source as governments around the world look for environmentally friendly solutions to potential future energy shortages. In order to capture more energy from the wind, larger turbines are being designed, leading to the structures becoming increasingly vulnerable to damage caused by violent gusts of wind. Advance knowledge of such gusts will enable turbine control systems to take preventative action, reducing turbine maintenance costs. We present a system which can accurately forecast the velocity profile of an oncoming wind, given only limited spatial measurements from light detection and ranging (LiDAR) units, which are currently operational in industry. Our method combines nonlinear state estimation techniques with low-order models of atmospheric boundary-layer flows to generate flow-field estimates. We discuss the accuracy of our velocity profile predictions by direct comparison to data derived from large eddy simulations of the atmospheric boundary layer.

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