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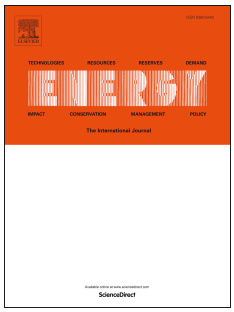

Detection and compensation of anomalous conditions in a wind turbine

S. Hur, L. Recalde-Camacho, W.E. Leithead

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Detection and compensation of anomalous conditions in a wind turbine

S. Hur[a,*], L. Recalde-Camacho[a], W.E. Leithead[a]

[a] *Wind Energy & Control, Department of Electronic and Electrical Engineering, University of Strathclyde, Glasgow, UK*

Abstract

Anomalies in the wind field and structural anomalies can cause unbalanced loads on the components and structure of a wind turbine. For example, large unbalanced rotor loads could arise from blades sweeping through low level jets resulting in wind shear, which is an example of anomaly. The lifespan of the blades could be increased if wind shear can be detected and appropriately compensated. The work presented in this paper proposes a novel anomaly detection and compensation scheme based on the Extended Kalman Filter. Simulation results are presented demonstrating that it can successfully be used to facilitate the early detection of various anomalous conditions, including wind shear, mass imbalance, aerodynamic imbalance and extreme gusts, and also that the wind turbine controllers can subsequently be modified to take appropriate diagnostic action to compensate for such anomalous conditions.

Keywords:
Wind turbine anomaly detection, anomaly compensation, wind turbine control, Extended Kalman Filter

1. Introduction

The controller for a wind turbine has the basic objective of ensuring that the turbine operates according to its design strategy; that is, rotor torque, rotor speed and power are maintained at the appropriate values according to wind speed. In addition, for large wind turbines the controller is required to reduce various structural loads on the blades, rotor and drive-train.

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*Corresponding author
Email address: hur.s.h@ieee.org (S. Hur)