Estimation and Control of Wind Turbine Tower Vibrations Based on Individual Blade-Pitch Strategies - DTU Orbit (05/05/2019)

In this brief, we present a method to estimate the tower fore-aft velocity based upon measurements from blade load sensors. In addition, a tower dampening control strategy is proposed based upon an individual blade pitch control architecture that employs this estimate. The observer design presented in this brief exploits the Coleman transformations that convert a time-varying turbine model into one that is linear and time-invariant, greatly simplifying the observability analysis and subsequent observer design. The proposed individual pitch-based tower controller is decoupled from the rotor speed regulation loop and hence does not interfere with the nominal turbine power regulation. Closed-loop results, obtained from high fidelity turbine simulations, show close agreement between the tower estimates and the actual tower velocity. Furthermore, the individual-pitch-based tower controller achieves a similar performance compared with the collective-pitch-based approach but with negligible impact upon the nominal turbine power output.

General information
Publication status: Accepted/In press
Organisations: Technical University of Denmark, Department of Wind Energy, Wind turbine loads & control, University of Sheffield
Contributors: Lio, W. H., Jones, B. L., Rossiter, J. A.
Publication date: 16 May 2019
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Control Systems Technology
ISSN (Print): 1063-6536
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Keywords: Active damping control, Kalman filter, state estimation of dynamical systems, wind energy.
DOIs:
10.1109/TCST.2018.2833064
URLs:
http://www.scopus.com/inward/record.url?scp=85047020072&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 85047020072
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review