LadHyX Seminar – January 25th, 10:45

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Field measurements on wind turbine towers for Reynolds number disparity and Vortex-Induced Vibration

Large wind turbine is susceptible to vortex-induced vibration (VIV) due to incoming wind close to the critical velocity of tower's natural frequency, both during installation and idle (non-operational) periods. In addition, VIV can interact with interference galloping when the wind turbine towers are transported for offshore wind farms. In the recent decades, studies and prediction methods for VIV have been continuously investigated. Application of prediction models for large slender structures have been included in most standards such as CICIND and Eurocode to predict the maximum amplitude or standard deviation of the response. However, the question of Reynolds number disparity still remains, as most models tested in the wind tunnel experience lower Reynolds numbers compared to a very high Reynolds number of flow around wind turbine towers ($\mathrm{Re} > 10^6$). Furthermore, the effect of natural wind with turbulence on vortex resonance has yet to be fully explored through field investigations. To investigate not only the Reynolds number disparity, but also to promote knowledge transfer and application of current VIV approaches to full-scale wind turbines, the full-scale surface pressure, wind and response measurements of wind turbine towers are performed at Østerild, Denmark. In more than two years of measurement campaigns, insights and development of vortex shedding parameters have been gained to further develop the current VIV prediction approaches. Interesting findings and observations have also been made, such as trends in Strouhal number, cross-wind buffeting and recorded 2nd mode VIV on fully built idle wind turbine. The aim of this seminar is to share the approaches and results of the field measurement campaign on wind turbine towers by Ruhr-University Bochum and Siemens Gamesa Renewable Energy. The measurement campaign is part of the DFG research project "Modelling the aeroelastic response of slender structures to vortex-induced vibrations: Transfer to industry through a large-scale experimental campaign on a wind turbine" project number 493357786.