ACOUSTIC DAY 2018

DTU Wind Energy

May 17th, DTU-Risø Campus, Roskilde (DK)

List of speakers and abstracts

Jesper MOGENSEN, Miljø- og Fødevareministeriet (Ministry of Environment and Food of Denmark)

Title: Adjustments in the regulation of noise from wind

Abstract: The Danish EPA and the Ministry of Environment and Food are working on a number of adjustments to the statutory order on noise from wind turbines. The technical adjustments include a graduated penalty for clearly audible tones and differentiated sound insulation values for summerhouse areas and residences. The technical adjustments also include a correction to the calculation method for noise from offshore wind turbines and the corrected method takes into account a contribution from multiple reflections at sea. The adjustments also include a clarification of the transitional provisions applying if the wind turbine is altered and thus emitting more noise as well as the possibility for the authority to order the owner of an offshore turbine to make noise emission control measurements.

Bo SØNDERGAARD, SWECO (DK)

Title: Low frequency sound insulation of buildings in relation to wind turbine

Abstract: The danish regulations for wind turbines includes noise criteria for low frequency noise. In the regulations a set of standard data for the insertion loss of typical danish houses at frequencies from 8 Hz to 200 Hz are tabled for use in noise predictions. In 2016 and 2017 two new investigations were initiated by the danish EPA on low frequency (LF) sound insulation in buildings at the countryside in Denmark. Both investigations are related to noise from wind turbines but the results can be used in general. The purpose with first investigation - to establish a more precise determination on LF sound insulation in typical houses - was fulfilled due to a mapping in 16 houses/24 rooms, roughly a doubling of the former data. The purpose

of the second investigation was to establish new knowledge on how to improve LF sound insulation in existing Danish houses in areas with wind turbines. This investigation includes: (1) a literature survey to establish existing knowledge, (2) measurements and experiments on 23 building constructions to investigate how to improve sound insulation on heavy and lightweight facades by means of building elements and one experiment using a room acoustic approach. Some of the conclusions are that it – in some cases – is possible with traditional indoor sound re-isolation or by outdoor façade sound-isolation to improve the LF sound insulation significantly.

Sabine VON HÜBERNEIN, University of Salford (UK)

Title: Annoyance from wind turbine noise? Review of wind turbine noise studies of the last two decades

Abstract: In agreement with other environmental noise literature, most work on the annoyance from wind turbines has focussed on noise. Notable work has been carried out in Sweden, the Netherlands, Japan, China, Canada and the US. Their results seem to show that the noise from wind turbines starts to annoy at sound levels that are much lower than that of other sources such as road or rail traffic. At the same time other factors are identified that also correlate highly with annoyance ratings. The presentation will critically review the evidence and raise the question whether it is time to shift the focus from noise annoyance to a much broader view on the factors affecting the acceptance of wind energy installations.

Lars Sommer SØNDERGAARD, DELTA (FORCE Technology, DK)

Title: Measurement at neighbor position

Abstract: Project for the Danish EPA to investigate whether the current guidelines for measurement of noise emission and noise propagation calculation from wind turbines described in the Danish Statutory Order give an accurate noise contribution at residents and to make measurements under conditions other than the Danish Statutory Order prescribes.

Jérémy HURAULT & Kaj Dam MADSEN, VESTAS Wind Systems (DK)

Title: Developments in Acoustics at Vestas Wind Systems A/S

Abstract: The presentation will hold a short introduction on the perspectives and then a more detailed presentation on aero-acoustic developments.

Tomas Rosenberg HANSEN, SIEMENS-GAMESA (DK)

Title: Developments in wind turbine noise: limitations and opportunities

Abstract: Noise from wind turbines is one of the constraining factors for how many wind turbines will be built in the future and thereby how much clean energy we can produce by use of onshore wind turbines. What will be the important factors to ensure turbines also in the future? Which are the limitations Siemens-Gamesa sees in the market related to noise and how do we react to this?

Franck BERTAGNOLIO, DTU Wind Energy (DK)

Title: Cross-cutting activities and wind turbine noise

Abstract: In this presentation, self-financed research activities (so-called CCA) currently conducted at DTU Wind Energy on a Vestas V52 test turbine are described with focus on measurements related to noise. Furthermore, some measurements are compared with the HAWC2-noise model which combines the well-known aeroelastic and load prediction code with a recently implemented noise module. Some features of the software are also presented.

Wen Zhong SHEN, DTU Wind Energy (DK)

Title: Recent developments in noise propagation modelling

Abstract: Wind turbine noise from source to receiver is a complicated process, which is influenced by atmospheric conditions and turbine operation conditions. This talk summarizes the recent developments at DTU in modelling the noise propagation process which include the coupling modelling of atmospheric flow, wind turbine wake flow, noise source and noise propagation, as well as the moving source strategy.

Mark KELLY, DTU Wind Energy (DK)

Title: Statistical prediction of far-field wind turbine noise, with probabilistic characterization of atmospheric stability

Abstract: Here we provide statistical low-order characterization of noise propagation from a single wind turbine, as affected by mutually interacting turbine wake and environmental conditions. This is accomplished via a probabilistic model, applied to an ensemble of atmospheric conditions based upon atmospheric stability; the latter follows from the basic form for stability distributions established by Kelly and Gryning (2010). For each condition, a parabolic-equation acoustic propagation model is driven by an atmospheric boundary-layer

("ABL") flow model; the latter solves Reynolds-Averaged Navier-Stokes equations of momentum and temperature, including the effects of stability and ABL depth, along with the drag due to the wind turbine. Sound levels are found to be highest downwind for modestly stable conditions not atypical of mid-latitude climates, and noise levels are less elevated for very stable conditions, depending on ABL depth.

The probabilistic modelling gives both the long-term mean and rms noise level as a function of distance, per site-specific atmospheric stability statistics. The variability increases with the distance; for distances beyond 3 km downwind, this variability is the highest for stability distributions that are modestly dominated by stable conditions. However, mean noise levels depend on the widths of the stable and unstable parts of the stability distribution, with more stably-dominated climates leading to higher mean levels.

Christrian BAK, DTU Wind Energy (DK)

Title: Status of the National Wind Tunnel

Abstract: n/a.

Andreas FISCHER, DTU Wind Energy (DK)

Title: The acoustic measurement setup in the Poul la Cour Wind Tunnel

Abstract: The Poul La Cour Wind Tunnel provides the possibility to test aerofoils at high Reynolds numbers. It can be configured in two different set-ups: the aerodynamic and the acoustic setup. This talk focuses on the acoustic set-up which is similar to the one developed at Virginia Tech. It consists of large Kevlar walls that allow the sound to propagate, but contain the flow. The test section is surrounded by a large anechoic chamber where an 84 channel Brüel&Kjær microphone array is located. Array data processing techniques to extract the aerofoil noise will be presented.
