> JOURNEE DES DOCTORANTS

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Numerical workflow for physical and perceptual prediction of wind turbine noise in complex rural environment

Andrea, Bresciani

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CONTEXT AND OBJECTIVES

Context

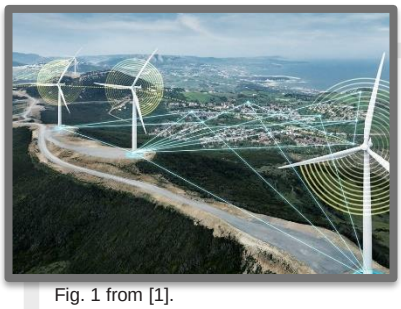


Fig. 1 from [1].

The deployment of green Aeolian energy in cities is an important component of future environmentally-friendly Smart Cities. The societal acceptance of urban wind parks will be strongly affected by their visual and **acoustic** impact.

Objectives

Near field source modeling

- Robust and accurate method for airfoil noise prediction
- Automation of the workflow

Noise propagation in complex environments

- Analysis of the impact of terrain topology and atmospheric effects on noise emissions

Wind turbine noise auralization

- Audio synthesis to investigate the acoustic annoyance for societal acceptance

METHODS

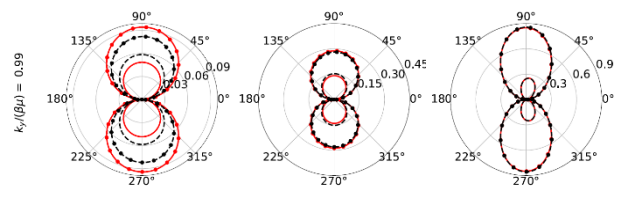
RANS
- Reynolds-Averaged Navier-Stokes simulations to compute mean flow properties

Amiet's model
- Analytical model [2] to compute the leading and trailing edge noise

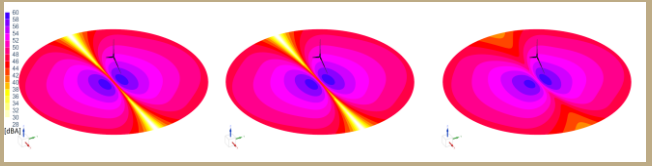
Ray-based method
- Harmonoise model [3] to simulate the far-field noise propagation in a complex urban environment

RESULTS

1. Improved Amiet's theory for low-frequency noise



2. Free-field wind turbine noise predictions considering the flexibility of the blades

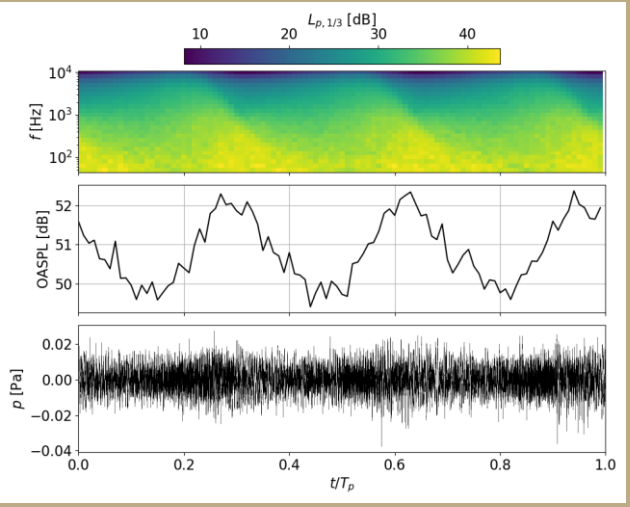


OASPL computed with **rigid** blades.

OASPL computed with **pitchwise-flexible** blades.

OASPL computed with **fully-flexible** blades.

3. Wind turbine noise auralization



Scan the QR code to hear the noise emitted by a wind turbine! The audio signal has been generated from a numerical workflow.

PERSPECTIVES

1. **Impact of a complex terrain topology on wind turbine noise propagation**
2. **Effect of the atmospheric turbulence on the perceived sound**
3. **Listening tests to assess the accuracy of the reconstructed noise signal**

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[1] *https://new.siemens.com/global/en/markets/wind.html*
[2] *R.K. Amiet (1976). Noise due to turbulent flow past a trailing edge. Journal of Sound and Vibration, Volume 47, Issue 3.*
[3] *E. Salomons, D. van Maercke, J. Defrance, F. de Roo (2011). The Harmonoise sound propagation model. Acta Acustica united with Acustica, Volume 97.*