Review of manuscript wes-2025-248: Method for using spectral flow data to predict vortex-induced vibration onset of static structures

The paper "Method for using spectral flow data to predict vortex-induced vibration onset of static structures" presents a computational framework for identifying the onset of vortex-induced vibration (VIV) using spectral flow data from CFD and experiments. The proposed VorLap open-source Python framework extracts dominant shedding frequencies and expresses them as Strouhal numbers and force coefficients. These spectral features are then interpolated to estimate local shedding frequencies, amplitudes, and phases across a structure. This further enables frequency-overlap screening with structural modes and the reconstruction of approximate time-domain aerodynamic loads. The tool appears adequate for the presented verification cases, but it is still in a preliminary stage and offers further room for improvement, some of which is acknowledged by the authors.

Overall, the manuscript is well written, although there are some instances where the readability could be improved.

Specific comments

1. Please use the unit of wind speed as m/s instead of ms^{-1} throughout the paper.
2. In line 44, please explain the relevant Reynolds number regime for Strouhal number mentioned.
3. The variable A_k, as shown in equation 5, is not explained in Section 2.1.
4. Please introduce/explain the variable ϕ_k in Section 2.1.
5. Please cite from where the data is taken for Figures 1-3.
6. In line 112, what is the actual expected Strouhal number for the datasets and why exactly is the Strouhal number increased by 0.07? Also show/cite the datasets for better understanding.
7. Improve Figure 4 by clearly marking the corresponding velocity vectors explained in the section. Lines 129-130 explain that the inflow velocity vector is shown in blue and the rotation vector in black. But in Figure 4, they are shown as black and dashed black, respectively. Please correct for consistency.
8. It would be better to explain Algorithm 1 further to avoid confusion. For example, the terms worst & above filter thresholds are introduced in the algorithm with no further explanations in the corresponding section.
9. Figure 5 shows that the reconstructed signal is in good agreement with the original (within 5%). How is this calculated?
10. Please mention the dataset source in line 254.
11. Since VorLap relies on Strouhal numbers extracted from CFD or experimental data, how sensitive are the predicted frequency-overlap metrics and reconstructed aerodynamic loads to uncertainties in the source spectral data? For example, studies such as Ebstrup et al. [1] report Strouhal numbers of approximately 0.33 and 0.48 for the same cylinder when using URANS and IDDES, respectively. Has any sensitivity analysis been performed to quantify the impact of these

discrepancies on the predicted onset of VIV and reconstructed aerodynamic loads?

12. The turbine global directions mentioned in lines 310 and 311 can also be represented in Figure 4 for better visualisation.

13. Please correct the following references as either the DOI is broken, or the authors list/ paper name is wrong.

- Bidadi, S., Vijayakumar, G., Deskos, G., and Sprague, M. A.: Three-dimensional aerodynamics and vortex-shedding of wind turbine airfoils over 360-degree angles of attack, Energies, 17, 4328, https://doi.org/10.3390/en17154328, 2024.
- Chen, J.M. and Fang, Y. C.: Strouhal numbers of inclined flat plates, Journal ofWind Engineering and Industrial Aerodynamics, 61, 99–112, https://doi.org/10.1016/0167-6105(96)00019-0, 1996.
- Fernandez-Aldama, R., Martínez-Tossas, L. A., Sarlak, H., and Breton, S. P.: Vortex-shedding regimes and lock-in for a wind turbine airfoil at 90○ incidence, Wind Energy Science, 10, 17–39, https://doi.org/10.5194/wes-10-17-2025, 2025.
- Grinderslev, C., Zahle, F., Barlas, E., and Madsen, H. A.: Multiple stable limit cycle amplitudes of standstill wind turbine blade vibrations due to vortex-induced excitation, Wind Energy Science, 7, 2201–2213, https://doi.org/10.5194/wes-7-2201-2022, 2022.
- Grinderslev, C. et al.: Forced-motion simulations of vortex-induced vibrations on wind turbine blades, Wind Energy Science, 8, 1625, https://doi.org/10.5194/wes-8-1625-2023, 2023.
- VimalKumar, S., Korkut, E., Barlas, E., and Zahle, F.: Force-partitioning analysis of vortex-induced vibrations of wind turbine tower sections, Wind Energy Science, 9, 1967–1983, https://doi.org/10.5194/wes-9-1967-2024, 2024.

Comments to improve readability

1. Grammar needs to be checked for line 29-31.
2. The lines 33-36 need rephrasing, as it is tough to read.
3. A better representation is appreciated to show the inflow velocity range in Table 1.
4. The lines 297-301 need a grammar check and improvement for better readability.

References

[1] K Ebstrup et al. 2024 J. Phys.: Conf. Ser. 2767 022048.