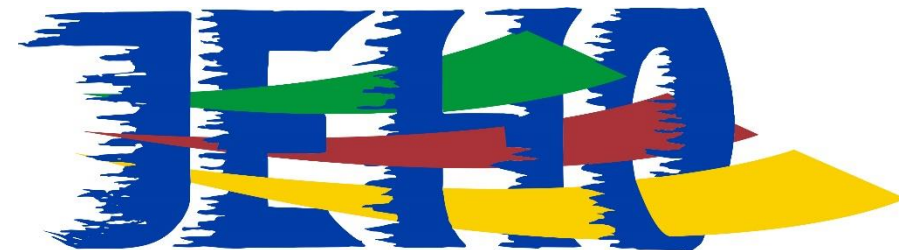


JEHO BV

Introduction

J.G. Holierhoek




JEHO BV

- Started in 2015 by Jessica Holierhoek
 - Studied aerospace engineering, Delft University: buckling, 2000
 - Continued working as researcher and teacher at Delft University
 - Research: wind turbine aeroelasticity, tool development & identifying possible instabilities
 - Teaching: 3-D dynamics, airplane performance, MSc projects,...
 - Combined research from Dutch and EU projects to PhD thesis: 2008
 - Started at ECN in 2007: research in the field of wind turbine aeroelasticity & consultancy activities in the same field, problem solving, aerodynamic modules, SIMPACK calculations, PHATAS calculations, Blademode development,...
 - JEHO BV since 2015: training & aeroelastic analysis, tool development, anything that the experience allows me to do for wind energy
 - Since 2016 1 day a week teacher at Delft University, guiding MSc students, PhD students & giving lectures in wind energy aeroelasticity
- Provides services to wind energy industry
- High quality due to almost 20 years of experience in wind energy
- Focus of experience on wind turbine instabilities and resonances
- But also more broad knowledge of wind energy, 3-D dynamics, aerodynamics, airplane performance,...



JEHO BV

- Many different problems occur on wind turbines, in design phase, proto type phase or even when already in the field
- Post-processing measurement data to try to identify cause of the vibrations
- Vibrations or issues are often hard to explain, but with extensive experience, it has become possible to explain most of the vibrations that I have seen
- Issues include: strong vibrations of...  Everything is always treated fully confidential
- Client names are usually not shared.





Aeroelastic analysis!!!

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- We are strong supporters of performing additional analysis of a wind turbine design: aeroelastic analysis
- Evaluate if there are possible resonances and instabilities that did not show up (or not clearly) in the calculated DLC's
 - Sometimes aeroelastic analysis is done using a linearised tool in our experience this can include simplifications that result in significant differences between analysis and reality
 - The nonlinear time simulation tool that is used has to be selected well, the model must not include certain simplifications that will result in inaccuracies that are not allowable
 - Note that e.g. if a situation is close to an instability, only a small difference in wind speed or pitch angle can change the situation to unstable => the safety margin on the calculated loads than no longer covers the larger vibrations



Current issues

- Tower frequency too close to steady rotor speeds or multiples of rotor speed. (Large differences in results using different tools)
- Blade frequencies too close to nP values
- Classical flutter speed or other instability in overspeed not far enough from rated speed
- Edgewise modes have little damping
 - Detailed blade model of vital importance: coupling with torsion must be included correctly, using steady mode shapes is inaccurate!
- Torsion modes with little damping
- Idling (parked) instabilities
- Vortex shedding



What do we offer?

- Aeroelasticity courses and training
 - In Rotterdam, Hamburg or in the offices of the client
- Aeroelastic design evaluation
 - Using OpenFAST or a tool under the client's license (experienced using FOCUS/PHATAS, Bladed, Simpack)
- Calculation of classical flutter speed
- Problem identification
 - Could be in design phase in the tool: realistic vibrations or not?
 - Could be in design phase: how to change the design effectively?
 - Can be on prototype or production models: what is the cause, could we have predicted this using calculations, how can we reduce the problem on current turbine(s).
- Tool development
 - We have developed the tool WAF1C that will calculate aerodynamic damping for an inputted mode shape (including phase differences)
 - We have experience developing aerodynamic modules, coupling different tools, aeroelastic time simulation tools, ...
- Support: need an engineer for a short while that already knows everything of WT's, DLC's,...





Thank you for your
attention



If you hire JEHO BV you get:

- The best available quality
- A devoted person working on your project
- Complete and utter confidentiality
- A person convinced that she contributes to improving wind energy
- A very good teacher, never too tired to explain
- No 9-5 mentality, if something has to be finished asap, it is finished asap, but without sacrificing quality.

