

Fluid Structure Interaction Capabilities of ExaWind Aerodynamics Coupled with OpenFAST Beam Models

M. Sprague, G. Vijayakumar, A. Sharma, P. Sakievich, N. Matula, N. deVelder

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1 Abstract

This document summarizes the coupling between ExaWind and OpenFAST designed to model fluid structure interactions. The general assumptions and limitations of the models used are discussed, the coupling method including surface mesh deformations introduced, and the results compared to rigid structures. Additionally, the numerical performance is presented, and future recommendations outlined. Overall, the coupling performs well in the x to y regions, but begins to degrade in z way when d begins to exceed a value of k.

2 Introduction

Motivation for FSI - some of the history, what has lacked, possible alternatives to our method and why they weren't chosen, and how our solution should be great, at least for this paper.

3 ExaWind

A little on the history, some on the underlying models, the models we are using, related assumptions, and limitations, and also some on the workflow, with a link to the software.

4 OpenFAST

Same as for ExaWind above, but for the OpenFAST items being used

5 Turbine Setup Definition

Discussions on the turbine(s) used, the overall input parameters, any simplifications or assumptions and how they might impact the simulations, and a link to the repository where all the runs were done.

6 Coupling Methodology

Discussion on how the two codes are coupled in a numerical sense and the assumptions/limitations, also how they are physically coupled.

Discussions on the mesh deformation algorithm, on negative volumes, and what was done to overcome that, and the implications of the simplifications/modifications

7 Rigid vs FSI

Show how the FSI changes the results, add detail required for understanding, discuss limitations and issues, also cover operation and controller

8 Power Performance

Show comparison between FSI and rigid power performance curves, discuss the reasons why they are different and if that difference aligns with reality

9 Numerical Performance

Discuss parallelization efficiency, memory efficiency, overall time per revolution/relevant metric

10 Conclusions and Future Work

Talk about how the objectives (milestones) were met and not met, what could be done better in the future, and the overall performance of the work and its importance