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A FLUID STRUCTURE INTERACTION STUDY OF A LARGE SCALE WIND TURBINE BLADE USING preCICE

Rachael Smith[1], Gerasimos Chourdakis[2], Gavin Tabor[3], Benjamin Uekermann[4]

[1] University of Exeter, Penryn Campus, Treliever Road, Penryn TR10 9FE, UK, rs495@exeter.ac.uk
[2] Technical University of Munich, Boltzmannstr. 3, 85748 Garching, Germany, chourdak@in.tum.de, https://www5.in.tum.de/~chourdak
[3] University of Exeter, Prince of Wales Road, Exeter, Devon, EX4 4SB, UK, g.r.tabor@exeter.ac.uk, http://emps.exeter.ac.uk/engineering/staff/grtabor
[4] University of Stuttgart, Postfach 10 60 37, 70049 Stuttgart, Germany, benjamin.uekermann@ipvs.uni-stuttgart.de, https://github.com/uekerman

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As new designs for wind turbine blades become longer to accommodate increasingly large turbines, the structures become more flexible as design efforts are made to reduce material requirements and therefore cost [1]. These highly flexible blades may have large deformations and complex aeroelastic behaviour that must be understood in order to avoid structural failure. In this work, a high order methodology for fluid structure interaction simulations of blade bending using the multi-physics coupling library preCICE is introduced. The computational fluid dynamics code OpenFOAM is two way coupled with the finite element code CalculiX. The methodology is firstly validated for cantilever bending against a benchmark study from the literature, and is then used to simulate a large wind turbine blade with varying airfoil section along its span. The blade is simulated in a feathered position without rotation at a high wind speed in order to study the possible extreme loading that may occur when the wind turbine is in survival mode. The resulting blade bending and stress information is compared against the output from the engineering code FAST, and the possible applications of this methodology in the wind turbine blade design process are discussed.

REFERENCES

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