Dokumenttyp: Zeitschriftenaufsatz

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Titel des Beitrags: Fully coupled co-simulation of a wind turbine emergency brake maneuver

Abstract: Co-simulation is a popular numerical method to solve complex multiphysics problems. The co-simulation method has an intrinsic advantage: it allows well-established and specialized simulation tools to be reused and combined with minor adaptations, in contrast to the monolithic approach. We employ a novel co-simulation approach to simulate a fully-coupled emergency brake maneuver scenario of the National Renewable Energy Laboratory (NREL) Unsteady Aerodynamics Experiment (UAE) Phase VI wind turbine. Within this simulation the acceleration and deceleration of the turbine are a result of the interaction of the blades, generator/gearbox, control unit and the flow field. The simulation results are validated against measurement data from the NREL UAE Phase VI performed in the NASA Ames wind tunnel. Using the co-simulation approach, in contrast to the investigations of various other research groups, this work provides a methodological framework to perform simulations much closer to real physics. This is realized by taking into account the interaction of blades, generator/gearbox, control unit and fluid at the same time. Thus, the usual approximations and assumptions on the single fields, which become necessary due to the artificial decoupling, are not needed, e.g. prescribing certain behavior. Moreover, the full flexibility of co-simulation is combined with the stability of a monolithic approach applying the novel Interface
Jacobian-based Co-Simulation Algorithm (IJCSA).

Stichworte: Co-simulation; Wind turbine; Emergency brake maneuver; Unsteady Aerodynamics Experiment Phase VI; IJCSA

Zeitschriftentitel: Journal of Wind Engineering and Industrial Aerodynamics

Jahr: 2015
Band: 144
Jahr / Monat: 2015-09
Quartal: 3. Quartal
Monat: Sep
Seiten: 134-145
Reviewed: ja
Sprache: en
Volltext / DOI: doi:10.1016/j.jweia.2015.03.021
Verlag / Institution: Elsevier B.V.
Status: Verlagsversion / published

TUM Einrichtung: Lehrstuhl für Statik

Occurences: Einrichtungen > Fakultäten > Ingenieurfakultät Bau Geo Umwelt > Lehrstühle > Lehrstuhl für Statik (Prof. Bletzinger) > Journalbeiträge > 2015

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