DCAMM SEMINAR

APPLIED MATHEMATICS AND MECHANICS

FS939 28 August 2018

A DCAMM seminar No. 728 will be presented by

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The title of the lecture is

Navier-Stokes CFD for wind turbine aerodynamics: the yawed wind case

Abstract:

Several aerodynamic regimes of horizontal axis wind turbines (HAWTs) can be viewed as periodic. Unsteady aerodynamic flows past structures result in mechanical fatigue, shortening structure life and, in the HAWT case, adversely impacting on wind cost of energy. Thus, accurate predictions of wind turbine unsteady aerodynamics can contribute to cost reductions, but time-domain (TD) Navier-Stokes (NS) Computational Fluid Dynamics (CFD), a simulation technology yielding such prediction improvements, requires often unaffordable computing resources. In this talk, we discuss the nonlinear frequency-domain harmonic balance NS CFD approach to HAWT periodic aerodynamics, and demonstrate its strengths by considering the aerodynamics of yawed wind aerodynamics.

Multimegawatt HAWTs often operate in yawed wind transients, in which the resulting periodic loads acting on blades, drive-train, tower, and foundation adversely impact on fatigue life. Accurately predicting yawed turbine aerodynamics and resulting structural loads is a challenging task, and requires computationally expensive NS CFD. This high computational cost can be significantly reduced by using a frequency-domain framework. The talk summarizes the main features of the COSA harmonic balance Navier-Stokes solver for the analysis of open rotor periodic flows, presents initial validation results based on the analysis of the NREL Phase VI experiment, and discusses the application of this technology to the analysis of a multimegawatt turbine in yawed wind. These analyses indicate that the HB solver determines the considered periodic flows from 30 to 50 times faster than the conventional TD approach with negligible accuracy penalty compared to the latter.

DATE:	**Friday, 31 August 2018**
TIME:	**11:00 – 11:45 + questions**
PLACE:	**Room 065E, Building 414 (027)** DTU, Technical University of Denmark

Danish pastry, coffee and tea will be served 15 minutes before the seminar starts.

All interested persons are invited.

Niels Leergaard Pedersen