



SEMINAR

APPLIED MATHEMATICS AND MECHANICS

FS953

5 April 2019

A DCAMM seminar No. 740 will be presented by

Associate Professor Krzysztof Rogowski
Warsaw University of Technology
The Institute of Aeronautics and Applied Mechanics
Warsaw, Poland

The title of the lecture is

CFD simulation of vertical-axis wind turbines

Abstract:

The flow through the Darrieus wind turbine is very complex. In the upwind and in the downwind parts of the rotor the blades of the device work in different flow conditions. In the downwind side of the rotor the turbulent intensity is higher while the flow velocity is smaller compared to the upwind side of the rotor. This results in poorer blade performance and significant fluctuations in the torque of the entire rotor. Blade brackets and rotor shaft also have a significant influence on rotor performance.

During this seminar, the earlier results of the 40-kW rotor will be presented. The results for the rotor with NACA 0018 airfoils were obtained by using the unsteady RANS approach with the SST $k-\omega$ turbulence model. The numerical results performed using ANSYS Fluent solver were also compared with the results obtained using a CFD code FLOWer from German Aerospace Center that was continuously extended for wind energy applications at IAG and a vortex model from DTU. In the numerical studies, six four-digit airfoils of NACA series with various thickness and shape of the mean line are used. The highest power coefficient is obtained for NACA 2414 airfoil.

The second part of the seminar concerns to the CFD results of a small H-Darrieus rotor with a rotor diameter of 1 m operating at the tip speed ratio of 4.5. The results of velocity field obtained using the actuator cell model (ACM) and the $k-\omega$ SST turbulence model are compared with the PIV results from the works of Carlos Simao Ferreira. The work presents a significant impact of the rotor blades on the turbine shaft and the interaction of the aerodynamic wake of the shaft with the turbine blades.

DATE:	Tuesday, 23 April 2019
TIME:	14:00 – 14:45 + questions
PLACE:	413-045B

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

All interested persons are invited.

Niels Leergaard Pedersen

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