BIOGRAPHICAL SKETCH

Born in Japan
B.S. 2009, Tokyo Institute of Technology, Japan
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Time in Preparation: 2015—2017
Qualifying Examination Passed: Fall 2015

Published Papers:


FLORIDA ATLANTIC UNIVERSITY

COLLEGE OF ENGINEERING & COMPUTER SCIENCE

announces the

Ph.D. Dissertation Defense

of

TAKUYA SUZUKI

for the degree of

DOCTOR OF PHILOSOPHY (PH.D.)

Oct. 31, 2017 at 1:30 p.m.

in

Engineering West, Room 187
777 Glades Road
Boca Raton, FL
Fatigue Life Prediction of Composite Turbine Blades under Random Ocean Current Loading

A comprehensive study was performed to overcome the design issues related to Ocean Current Turbine (OCT) blades. Statistical ocean current models were developed in terms of the probability density function, the vertical profile of mean velocity, and the power spectral density. The models accounted for randomness in ocean currents, tidal effect, and ocean depth. The proposed models gave a good prediction of the velocity variations at the Gulf Stream.

A novel procedure was developed to couple Fluid-Structure Interaction (FSI) with blade element momentum theory. The proposed FSI analysis predicted a power loss of 3.1% due to large deflection of the OCT blade. The method contributed to saving extensive computational cost and time compared to a CFD-based FSI analysis.

The random ocean current loadings were calculated by considering the ocean current turbulence, wake flow behind the support structure, and velocity shear. Fatigue tests of GFRP coupons and composite sandwich panels under such random loading were performed. Fatigue life increased by a power function for GFRP coupons and by a linear-log function for composite sandwich panels as the mean velocity decreased. To accurately predict the fatigue life, a new fatigue model based on the stiffness degradation was proposed. Fatigue life of GFRP coupons was predicted using the proposed model, and a comparison was made with experimental results.

As a summary, a set of new design procedures for OCT blades has been introduced and verified with various case studies of experimental turbines.