BIOGRAPHICAL SKETCH

Born in Japan
B.S. 2009, Tokyo Institute of Technology, Japan
M.S. 2011, Tokyo Institute of Technology, Japan
Researcher 2011, IHI Corporation, Japan
Ph.D. 2017, Florida Atlantic University, Boca Raton, Florida

CONCERNING PERIOD OF PREPARATION & QUALIFYING EXAMINATION

Time in Preparation: 2015—2017

Qualifying Examination Passed: Fall 2015

Published Papers:

T. Suzuki, H. Mahfuz, and M. Canino, Resource Characterization and Statistical Modeling of Ocean Current at the Gulf Stream, *Marine Technology Society Journal*, vol. 51, no. 1, pp. 52-63, January 2017.

T. Suzuki and H. Mahfuz, Analysis of Large-Scale Ocean Current Turbine Blades using Fluid-Structure Interaction and Blade Element Momentum Theory, *Ships and Offshore Structures* (Under 2nd Review).

T. Suzuki, H. Mahfuz, and M. Canino, Fatigue Load and Life Estimation of Composite Turbine Blades under Random Ocean Current, *Proceedings of OCEANS 2015 - MTS/IEEE Washington*, Washington D.C., USA, October 2015.

T. Suzuki and H. Mahfuz, Non-Linear Modeling of Ocean Current Turbine Blades under Large Deflection, *ASME 2016 International Mechanical Engineering Congress and Exposition*, Phoenix, Arizona, USA, vol. 6B: Energy, November 2016.

FAU
COLLEGE OF ENGINEERING & COMPUTER SCIENCE
Florida Atlantic University

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

DEPARTMENT: Ocean and Mechanical Engineering

DISSERTATION TITLE: “Fatigue Life Prediction of Composite Turbine Blades under Random Ocean Current Loading”

CHAIR OF THE CANDIDATE’S PH.D. COMMITTEE:
Hassan Mahfuz, Ph.D.

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ABSTRACT OF DISSERTATION

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.