Casey M. Harwood

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Education

The University of Michigan, Ann Arbor, MI
Ph.D., Naval Architecture and Marine Engineering — Nov. 2016
Dissertation: "The Hydrodynamic and Hydroelastic Responses of Rigid and Flexible Surface-Piercing Hydrofoils in Multi-Phase Flows"
Committee chairs: Yin Lu Young and Steven L. Ceccio

The University of Michigan, Ann Arbor, MI
M.S.e., Naval Architecture and Marine Engineering — Dec. 2014
Research Topics: Experimental and numerical investigations of ventilation on rigid surface-piercing bodies
Advisor: Yin Lu Young

The Webb Institute, Glen Cove, NY
B.S., Naval Architecture and Marine Engineering — May 2011
Thesis: "Hydrodynamic Design of a Hydrofoil System for a High-speed Catamaran"
Advisor: Jacques B. Hadler

Awards, Honors, Fellowships, and Grants

Office of Naval Research (ONR) - PENDING — January, 2018 – January, 2021
Experimental Measurements of Waves and Vessel Dynamics in the Surf Zone for Modeling and Simulation Validation
Program Officer: Troy Hendricks, Code 30

ONR Grant #N00014-17-1-2554 (Co-PI with Prof. Pablo Carrica) — April, 2017 – April, 2019
Hydrodynamic Studies for Submersible Amphibious Combat Vehicles
Program Officer: Troy Hendricks, Code 30

National Science Foundation GRFP Fellow — May 2013 - May 2016

University of Michigan Rackham Regents Fellow — Sep. 2011 - Sep. 2012

Academic Appointments

The University of Iowa, Iowa City, IA — Jan. 2017 – Present
Assistant Professor
Department of Mechanical and Industrial Engineering

The University of Iowa, Iowa City, IA — Jan. 2017 – Present
Assistant Faculty Research Engineer
IIHR – Hydroscience and Engineering

Research Interests

- Experimental fluid dynamics
- Fluid-structure interactions
- Lifting surfaces and propellers
- Multi-phase flow (cavitation and ventilation)
- Alternative energy harvesting

Last Edited January 22, 2018

- Instrument design and data acquisition
- Reduced-order, surrogate, and inverse modeling
- Numerical methods

Peer-Reviewed Publications

Journal Articles

[1] Jacob Ward, Casey M. Harwood, and Yin Lu Young. "Inverse method for hydrodynamic load reconstruction on a flexible surface-piercing hydrofoil in multi-phase flow". In: *Journal of Fluids and Structures* 77 (2018), pp. 58–79.

[2] Yin Lu Young, Casey M. Harwood, Francisco Miguel M., Jacob C. Ward, and Steven L. Ceccio. "Ventilation of Lifting Bodies: Review of the Physics and Discussion of Scaling Effects". In: *Applied Mechanics Reviews* 69.1 (Jan. 2017), pp. 010801–010801-38.

[3] Casey M. Harwood, Yin L. Young, and Steven L. Ceccio. "Ventilated cavities on a surface-piercing hydrofoil at moderate Froude numbers: cavity formation, elimination and stability". In: *Journal of Fluid Mechanics* 800 (Aug. 2016), pp. 5–56.

[4] Casey M. Harwood and Yin Lu Young. "A physics-based gap-flow model for potential flow solvers". In: *Ocean Engineering* 88 (2014), pp. 578–587.

Articles in Conference Proceedings

[1] Casey M. Harwood, Jacob C. Ward, Mario Felli, Massimo Falchi, Steven L. Ceccio, and Yin Lu Young. "Experimental Measurements and Inverse Modeling of the Dynamic Loads and Vibration Characteristics of a Surface-Piercing Hydrofoil". In: *Fifth International Symposium on Marine Propulsors*. IN PRESS. Espoo, Finland, 2017.

[2] Casey M. Harwood, Jacob C. Ward, Yin Lu Young, and Steven L. Ceccio. "Experimental investigation of the hydro-elastic response of a surface-piercing hydrofoil in multi-phase flow". In: *Proceedings of the 31st Symposium on Naval Hydrodynamics*. Monterey, CA, Sept. 13, 2016.

[3] Jacob C. Ward, Casey M. Harwood, and Yin Lu Young. "Inverse method for determination of the in situ hydrodynamic load distribution in multi-phase flow". In: *Proceedings of the 31st Symposium on Naval Hydrodynamics*. Monterey, CA, Sept. 13, 2016.

[4] Casey M. Harwood, Andrew J. Stankovich, Yin Lu Young, and Steven L. Ceccio. "Combined experimental and numerical study of the free vibration of surface-piercing struts". In: *Proceedings of the International Symposium on Transport Phenomena and Dynamics of Rotating Machinery*. Honolulu, HI, Apr. 10, 2016.

[5] Casey M. Harwood, Kyle A. Brucker, Francisco Miguel Montero, Yin Lu Young, and Steven L. Ceccio. "Experimental and numerical investigation of ventilation inception and washout mechanisms of a surface-piercing hydrofoil". In: *Proceedings of the 30th Symposium on Naval Hydrodynamics*. Hobart, Tasmania, Nov. 5, 2014.

[6] Casey M. Harwood, Antoine Ducoin, and Yin Lu Young. "Influence of gap flow on the cavitating response of a rectangular hydrofoil". In: *Proceedings of the 2012 Propeller and Shafting Symposium*. Norfolk, VA: Society of Naval Architects and Marine Engineers, Sept. 12, 2012, pp. 11–12.

PRESENTATIONS

Invited Presentations

[1] Casey M. Harwood. "Flexing, Fluttering, and Singing: Fluid-Structure Interactions in the Marine Environment". MIE Graduate Seminar. University of Iowa, Iowa City, IA, Mar. 23, 2017.

[2] Casey M. Harwood. "Ventilation of Rigid and Flexible Surface-Piercing Hydrofoils". Mechanical and Industrial Engineering Faculty Candidate Seminar. University of Iowa, Iowa City, IA, Mar. 21, 2016.

[3] Casey M. Harwood. "Ventilation of Rigid and Flexible Surface-Piercing Hydrofoils". NAME Department Seminar. University of Michigan, Ann Arbor, MI, Jan. 22, 2016.

[4] Casey M. Harwood. "An experimental and numerical study of ventilation of a surface-piercing strut". Ocean Engineering Department Seminar. University of California at Berkeley, Berkeley, CA, Nov. 24, 2014.

[5] Casey M. Harwood. "A physics-based gap flow model for potential-flow solvers". SNAME H-8 Panel Meeting. Bethesda, MD, Jan. 2014.

[6] Casey M. Harwood. "Experimental and numerical investigation of ventilation inception and washout mechanisms". SNAME H-8 Panel Meeting. Bethesda, MD, Jan. 2014.

[7] Casey M. Harwood. "Influence of gap size on the hydrodynamic response of 3-D foils in fully-wetted and cavitating Flow". SNAME H-8 Panel Meeting. Bethesda, MD, Feb. 23, 2012.

Conference Presentations

[1] Casey M. Harwood, Yin Lu Young, Mario Felli, Massimo Falchi, and Steven Ceccio. "Scaling of Natural Ventilation and Vaporous Cavitation on a Surface-Piercing Hydrofoil". In: *International Symposium on Transport Phenomena and Dynamics and Rotating Machinery*. International Symposium on Transport Phenomena and Dynamics and Rotating Machinery. Maui, HI, Dec. 16, 2017.

[2] Casey M. Harwood, Jacob Ward, Yin Lu Young, Mario Felli, Massimo Falchi, and Steven Ceccio. "The Hydroelastic Response of a Flexible Surface-Piercing Strut in Wetted, Ventilated, and Cavitating Flows". In: vol. 61. Portland, OR: American Physical Society, 2016.

[3] Casey M. Harwood, Yin Lu Young, and Steven L. Ceccio. "Hydrodynamic and structural response of surface-piercing struts in ventilated flows". In: NEEC Annual Meeting. Poster Presentation. Bethesda, MD, Apr. 7, 2015.

[4] Casey M. Harwood, Yin Lu Young, and Steven L. Ceccio. "Experimental investigation of atmospheric ventilation on a surface-piercing hydrofoil". In: University of Michigan Engineering Graduate Symposium. Poster Presentation. Ann Arbor, MI, Nov. 14, 2014.

[5] Casey M. Harwood, Yin Lu Young, and Steven L. Ceccio. "Ventilation inception and washout, scaling, and effects on hydrodynamic performance of a surface piercing strut". In: *Bulletin of the American Physical Society*. APS 67$^{\text{th}}$ Annual Division of Fluid Dynamics. Vol. 59. Pittsburgh, PA: American Physical Society, Nov. 23, 2014.

[6] Casey M. Harwood, Francisco Miguel Montero Montero, Andrew J. Stankovich, Yin Lu Young, and Steven L. Ceccio. "Experimental investigation of ventilation on rigid and flexible surface piercing bodies". In: *17th U.S. National Congress on Theoretical and Applied Mechanics*. US National Congress on Theoretical and Applied Mathematics. East Lansing, MI, June 19, 2014.

[7] Andrew J. Stankovich, Casey M. Harwood, Francisco Miguel Montero, Yin Lu Young, and Steven L. Ceccio. "Numerical and experimental analysis of the added mass and resonance frequency of a cantilever hydrofoil in two-phase flow". In: *17th U.S. National Congress on Theoretical and Applied Mechanics*. US National Congress on Theoretical and Applied Mathematics. East Lansing, MI, June 19, 2014.

[8] Casey M. Harwood, Andrew J. Stankovich, Francisco Miguel Montero, Yin Lu Young, and Steven L. Ceccio. "The Effects of Ventilation on the Hydrodynamic and Structural Response of Surface-Piercing Struts". In: NEEC Annual Meeting. Poster Presentation. Bethesda, MD, May 19, 2014.

[9] Casey M. Harwood, Francisco Miguel Montero, Yin Lu Young, and Steven L. Ceccio. "Experimental investigation of ventilation of a surface piercing hydrofoil". In: *Bulletin of the American Physical Society*. APS 66$^{\text{th}}$ Annual Division of Fluid Dynamics. Vol. 1. Pittsburgh, PA: American Physical Society, Nov. 26, 2013.

Courses Taught

NA320: Marine Hydrodynamics I — Fall, 2016
Class size: 19 (Instructor of record)

ENGR:2510 – Fluid Mechanics (Engineering Core) — Fall, 2017
Class size: 96

ME:3025 – Heat Transfer — Spring, 2018
Class size: approx. 85

Guest Lectures

NA520: Wave Loads on Ships and Offshore Structures — Dec. 3, 2015
"Ocean Wave Spectra and the Statistical Description of Waves"

NA431: Marine Engineering — Mar. 30, 2016
"World Energy Use - A Survey"

ME:4176 – Experimental Naval Hydrodynamics — Mar. 21, 23, 2017
One-week lecture series: "Marine Propulsion Design and Experiments"

Industry Experience

Navatek LTD, Honolulu, HI — Winters 2010, 2011
Design Intern
Assisted in the design and testing of one-quarter and one-half scale manned models of UHAC/CAAT amphibious landing craft.

Horizon Lines, Tacoma, WA / Dutch Harbor, AK — Winter 2009
Shipboard Cadet
Serviced low- and medium-speed diesel engines and auxiliary support systems (cooling, lube and fuel oil, fire suppression, and electrical) as part of main propulsion and power-generation plants aboard the *M/V Kodiak* (Bering Sea trade-route).

Westport Shipyard, Westport, WA / Port Angeles, WA — Winter, Summer 2008
Design and Shipyard Intern
Gained experience in fiberglass construction (hand-layup, vacuum infusion, and large-parts layup) and worked as draftsman.

Professional Associations and Memberships

American Physical Society — 2013 - Present

Society of Naval Architects and Marine Engineers (SNAME)
Associate Member — 2007 - Present

Tau Beta Pi Collegiate Honor Society — 2012 - Present

Relevant Skills

Languages & Software: LaTeX, LabVIEW, MATLAB/Octave, R
Design and Drafting: AutoCAD, Rhinocerous, SolidWorks, CREO
Analysis and Simulation: ANYSY FEM, ANSYS CFX, OpenFOAM, Paraview
Fabrication / Construction: Carpentry, fiberglass layup techniques, basic machining