Exponent®
Engineering & Scientific Consulting


# Ming Chen, Ph.D.

Associate | Mechanical Engineering
Irvine
+1-949-242-6031 | chenm@exponent.com


## Professional Profile

Dr. Chen has an interdisciplinary background in structural mechanics and fluid mechanics, focusing on fluid-structure interaction analysis in the marine environment using analytical, experimental, and computational (Finite Element Analysis: FEA and Finite Volume Method: FVM) methods. Specifically, he specializes in wave mechanics, hydrodynamics and hydroelastic behavior of floating and submerged bodies, mooring systems, and offshore renewable energy.

Dr. Chen's expertise utilizes field measurements and data analysis, dynamic responses and failure analysis of marine and coastal structures, and physical prototype build/test. Through his skills and knowledge, Dr. Chen could serve clients from multiple industries including manufacturing, energy, maritime industry, and coastal construction.

Prior to joining Exponent, Dr. Chen worked as a postdoctoral scholar at Oregon State University and as a research associate at Pacific Marine Energy Center. In this position, he led projects including wave energy converters (WEC) system numerical modeling, validation, and performance analysis, autonomous underwater vehicle (AUV) docking lab experiment design and tests, and development of a framework for investigating and analyzing AUV recharging using wave energy.

Dr. Chen’s doctoral research focused on fluid-structure interaction analysis using computational methods and their offshore and coastal applications. Dr. Chen developed a nonlinear mooring line and umbilical dynamics code and incorporated the code into WEC-Sim software to improve its mooring and power cable calculation capability. In addition, he modeled, analyzed, and demonstrated a novel concept of free-floating longline binary species macroalgae farming system using OrcaFlex, and five potential failure modes were determined. Furthermore, breaking waves impact an elastic elevated wood coastal structure was modeled using both laboratory experimental tests and computational simulations, the specimen damages were characterized, and the computational results were used to develop an uplift pressure distribution equation which proposed to improve the current design manuals such as the CCM and ASCE 7-16.

## Academic Credentials & Professional Honors

Ph.D., Civil Engineering, Oregon State University, 2021

M.S., Civil and Construction Engineering, Oregon State University, 2014

B.S., Civil Engineering, Xi'an University of Architecture and Tech, 2009

 

## Prior Experience

Postdoctoral Scholar, Civil and Construction Engineering, Oregon State University, 2021 – 2022

Postdoctoral Research Associate, Pacific Marine Energy Center, 2021 - 2022

## Professional Affiliations

American Society of Mechanical Engineers (ASME)

## Languages

Chinese

## Publications

Chen M, Vivekanandan R, Rusch CJ, Okushemiya D, Manalang D, Robertson B, Hollinger GA, "A unified simulation framework for wave energy powered underwater vehicle docking and charging", Applied Energy, Volume 361, 2024, 122877, ISSN 0306-2619, https://doi.org/10.1016/j.apenergy.2024.122877.

Chen M, Yim SC, Cox DT, Yang Z, Huesemann MH, Mumford TF, Wang T. Modeling and analysis of a novel offshore binary species free-floating longline macroalgal farming system. Journal of Offshore Mechanics and Arctic Engineering 2023; 145(2): 021301.

Kim B, Adami N, Chen M, Yim SC. "Parametric Study of Umbilical Cable and Mooring Line Dynamics With Nonlinear Wave Propagation in Varying Sea Conditions." Proceedings of the ASME 2023 42nd International Conference on Ocean, Offshore and Arctic Engineering. Volume 8: Ocean Renewable Energy. Melbourne, Australia. June 11–16, 2023. V008T09A084. ASME. https://doi.org/10.1115/OMAE2023-108186.

Chen M, Ai S, Yim SC. A combined nonlinear mooring-line and umbilical cable dynamics model and application. Proceedings of ASME 2022 41st International Conference on Ocean, Offshore and Arctic Engineering, Hamburg, Germany, 5-11 June 2022.

Chen M, Yim SC, Cox DT, Yang Z, Mumford TF. Hydrodynamic analysis of macroalgae local model using computational fluid dynamics. Proceedings of ASME 2020 39th International Conference on Ocean, Offshore and Arctic Engineering, Virtual, 3-7 August 2020.

Chen M, Yim SC, Cox DT, Wang T, Huesemann MH, Yang Z, Mumford TF, Wood G. Hydrodynamic load modeling for offshore free-floating macroalgal aquaculture under extreme environmental conditions. Proceedings of ASME 2019 38th International Conference on Ocean, Offshore and Arctic Engineering, Glasgow, Scotland, UK, 9-14 June 2019.

Yim SC, Adami N, Bosma B, Brekken T, Chen M, Zadeh G, Glennon D, Lian Y, Lomonaco P, Mohtat A, Ozkan-Haller T, Thomson J. A preliminary study on the modeling and analysis of nonlinear effects of ocean waves and power-take-off control on wave energy conversion system dynamics. Proceedings of ASME 2019 38th International Conference on Ocean, Offshore and Arctic Engineering, Glasgow, Scotland, UK, 9-14 June 2019.

**Presentations**

Chen M, Vivehanandan R, Rusch C, Robertson B, and Hollinger G. A framework for wave-to-wire simulation of wave energy converter for autonomy underwater vehicle recharging. Oral presentation, Marine Energy Research Conference jointly sponsored by the Marine Energy Technology Symposium (METS) and University Marine Energy Research Community (UMERC), Portland, Oregon, USA, 2022.

Adami N, Mohtat A, Chen M, Lian Y, and Yim S. Nonlinear ocean waves and mooring-line dynamic system improvement in WEC-Sim. Poster presentation, University-Industry Research Collaboration Breakout Discussions at Pacific Marine Energy Center (PMEC) All-Center Meeting, Portland, Oregon, USA, Sep. 2019.

Chen M, Ai S, and Yim S. Robust model for mooring-line system. Poster presentation, Marine Renewable Energy Forum at the Northwest National Marine Renewable Energy Center (NNMREC), Portland, Oregon, USA, Sep. 2017.

## Project Experience

Developed hydrodynamic models of 3 different archetypes of WECs using a modeling framework containing Rhino 7, WAMIT, and ProteusDS software and determined the optimal hull sizes based on the metocean data to satisfy the power demand from 100W to 100kW.

Designed and planned a lab experiment to investigate hydrodynamic effects on AUV docking and validated the hydrodynamic model to be 90% accurate using the measurements.

Performed a WEC performance analysis to determine the optimal PTO damping under different periods of wave to support the control group and developed a WEC power matrix in different sea states to support the power modeling group.

Developed a nonlinear mooring-line and umbilical dynamics code using MATLAB/Simulink and integrated the code into WEC-Sim software to add a feature to model, analyze, and design the mooring system and power cord and the code has been validated to be about 90% accurate compared to the experimental data.

Modeled the free-floating longline macroalgae farming system under extreme waves and current using OrcaFlex and 5 potential failure modes were determined from the structural dynamic response analysis.

## Peer Reviews

Journal of Offshore Mechanics and Arctic Engineering