

# BAIHENG Wu

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## Work

### Norwegian University of Science and Technology

Jul. 2022 -

*Researcher/Postdoctoral Fellow*

*From Jul. 2022, Ålesund, Norway*

- Early-stage researcher at the Department of ICT and Natural Science, Faculty of Information Technology and Electrical Engineering. A member of the Cyber-Physical Systems Laboratory, led by Profs. [Robin T. Bye](#) and [Ottar L. Osen](#).

## Education

### Norwegian University of Science and Technology

Aug. 2016 – Oct. 2022

*Ph.D. in Ocean Operations, Faculty of Engineering*

*Jul. 2019 - Oct. 2022, Ålesund, Norway*

- Ph.D. thesis: Synthesis of Human-in-the-loop navigational operations towards maritime autonomous surface ships.
- Supervisors: Profs. [Guoyuan Li](#), [Houxiang Zhang](#), and [Hans Petter Hildre](#).

*Uniped Program - Pedagogical Basic Competence*

*Sep. 2021 - Sep. 2022, Ålesund, Norway*

- Pedagogy project: Interdisciplinary supervision on bachelor theses and projects in nautical science.
- Pedagogical study modules: Learning design for hybrid learning, Supervision.

*M.Sc. in Marine Technology - Marine Cybernetics*

*Aug. 2016 – Mar. 2019, Trondheim, Norway*

- GPA: B; thesis: Image Processing and Target Tracking Technology in the Sea Cucumber Fishing Application.
- Exchange student at Universidad Politécnica de Madrid, Madrid, Spain (Signal Processing and Fourier Transform) and Mines ParisTech, Paris, France (Logistics and Supply Chain Management).

### Tianjin University

Sep. 2012 – Jul. 2016

*B.Eng. in Ocean Engineering*

*Tianjin, P.R.China*

- GPA: 3.68/4.0.
- Exchange research assistant with [Prof. Michael S. Triantafyllou](#) and [Dr. Dixia Fan](#) at the Towing Tank Laboratory at Massachusetts Institute of Technology (MIT), Cambridge, USA.

## Research Interest

- |                               |                              |                                   |
|-------------------------------|------------------------------|-----------------------------------|
| • Human factors & Ergonomics  | • Applied machine learning   | • Fluid-structure interaction     |
| • Applied control engineering | • Risk analysis & management | • Physical-model based experiment |

## Projects & Fundings

*As the leader/manager/coordinator/first recipient:*

### Excited Mini Project: Engineering Practice of Mechatronics and Software for Robotics | *Leader*

Sept. 2022 - Aug. 2023

- Funded by NTNU with an amount of 60 000 NOK.
- The capability of engineering project practice is essential to the students, so it also demands the faculty to promote the delivery of such ability effectively. In project practice, the students utilize what they learn from class and practice in the project for a better grasp of the knowledge. Some of the student groups have also taken part in international contests to gain competence and expand influence. The pedagogical practice regarding engineering practice at IIR is on the way to being more organized and systematic.

### Startplugg: Intelligent Ship Bridge System for Learning Navigators' Operational Behaviors | *Leader*

Jul. 2021 - Jun. 2022

- Funded by NTNU with an amount of 50 000 NOK.
- Recording human navigators' physiological signals extensively, utilizing (and not limited to) electroencephalogram (EEG), eye tracker, gesture recognition, and body motion tracker; Synchronizing and interpreting recorded chronological data from multiple sensors; Modeling and summarizing operational behaviors based on synchronized and interpreted data; Establishing intelligent bridge surveillance and providing decision support to navigators in terms of behavioral models.

### Equinor Mobility Allowance | *Recipient*

Jun. 2022 - May 2023

- Sponsored by Equinor of 90 000 NOK.
- Attending high level international academic conferences (IEEE SMC 2022 in Prague, Czech Republic and IEEE/RSJ IROS 2022 in Kyoto, Japan); Conducting short research stay at the Robotics Institute, Carnegie Mellon University.

*As a core member:*

- Funded by Norges forskningsråd (the Research Council of Norway) as funding source for the postdoctoral fellowship.
- Developing and implementing: a robust autonomous navigation system capable of acting on uncharted obstacles while keeping human operators in-the-loop; capable tools and processes for safety assurance of related technology elements. The goals of the project will be tested and documented through experience and data collected from: controlled experiments using bridge-simulators and humans in-the-loop; deployment of technology on full scale operations of one of the Bastø Fosen operated ferry between Moss and Horten.

- Funded under the EEA Grants - Financial Mechanism 2014-2021 The Education, scholarships, apprenticeships and youth entrepreneurship programme (ESAYEP), 2014-2021.
- Romanian - Norwegian strategic cooperation in maritime higher education for enhancement human capital and knowledge base in field of marine intelligent technologies. Responsible for two publications (1 journal and 1 conference paper) in education and pedagogy.

- Funded by Norges forskningsråd (the Research Council of Norway).
- Focusing on the research on the human-centered intelligent ship-bridge system which enables data interface on real-time navigation monitoring and data exchange with a centralized land-based/waterborne remote control center.

- Funded by Norges forskningsråd (the Research Council of Norway) as main funding source for the Ph.D. fellowship.
- Focusing on the synthesis research on the human-in-the-loop control and learning system for autonomous maneuvering, by means of analyzing data collected from real ships and ship-bridge simulators, establishing risk models (navigating patterns) in different maneuvering scenes, and applying control schemes to promote the performance of human navigators.

## Publication

### Intelligence of Maritime Autonomous Surface ships

#### Journal

- [1] **Wu, B.**, Zhao, L., Hildre, H. P., Zhang, H., & Li, G.: Evaluation on Effectiveness of Electronic Chart System for Maritime Navigators Based on Visual Attention and Risk Assessment. IEEE Access. Under review.
- [2] Zhao, L., Thattavelil Sunilkumar, S. R., **Wu, B.**, Li, G., & Zhang, H.: Towards an Online Decision Support System to Improve Collision Risk Assessment at Sea, IEEE Intelligent Transportation Systems Magazine. Accepted.
- [3] **Wu, B.**, Li, G., Zhao, L., Aandahl, H. I. J., Hildre, H. P., & Zhang, H. (2021). Navigating Patterns Analysis for Onboard Guidance Support in Crossing Collision-Avoidance Operations. IEEE Intelligent Transportation Systems Magazine, 2021, 14(3): 62-77.
- [4] **Wu, B.**, Li, G., Wang, T., Hildre, H. P., & Zhang, H. (2021). Sailing status recognition to enhance safety awareness and path routing for a commuter ferry. Ships and Offshore Structures, 1-12.
- [5] Wang, T., Li, G., **Wu, B.**, Æsøy, V., & Zhang, H. (2021). Parameter identification of ship manoeuvring model under disturbance using support vector machine method. Ships and Offshore Structures, 1-9.

#### Conference

- [1] **Wu, B.**, Han, P., Hildre, H. P., Zhao, L., Zhang, H., & Li, G.: A Camera-based Deep-Learning Solution for Visual Attention Zone Recognition in Maritime Navigational Operations, IEEE/RSJ IROS 2022. Accepted.
- [2] **Wu, B.**, Sæter, M.L., Hildre, H. P., Zhang, H., & Li, G.: Experiment Design and Implementation for Human-in-the-Loop Study Towards Maritime Autonomous Surface Ships, IEEE SMC, Prague, Oct. 2022. Accepted.
- [3] **Wu, B.**, Zhao, L., Thattavelil Sunilkumar, S. R., Hildre, H. P., Zhang, H., & Li, G.: Eye-tracker-based Visual Attention Investigation in Maritime Collision-Avoidance Operations, ICCA, Naples, Italy, 2022. Accepted.
- [4] Han, P., Li, G., Skjong, S., **Wu, B.**, & Zhang, H. Data-driven sea state estimation for vessels using multi-domain features from motion responses. In 2021 IEEE International Conference on Robotics and Automation (ICRA) (pp. 2120-2126). IEEE.
- [5] **Wu, B.**, Li, G., Zhao, L., Hildre, H. P., & Zhang, H. A human-expertise based statistical method for analysis of log data from a commuter ferry. In 2020 15th IEEE Conference on Industrial Electronics and Applications (ICIEA) (pp. 1471-1477). IEEE.
- [6] Zhao, L., Li, G., Remøy, K., **Wu, B.**, & Zhang, H. Development of Onboard Decision Supporting System for Ship Docking Operations. In 2020 15th IEEE Conference on Industrial Electronics and Applications (ICIEA) (pp. 1456-1462). IEEE.

### Fluid-structure interaction

#### Journal (\*equal first authorship)

- [1] Li, A. \*, **Wu, B. \***, & Fan, D. (2022). Vortex-induced vibration of risers with staggered buoyancy modules of small aspect ratio. Applied Ocean Research, 120, 103014.

- [2] Wang, Z.\* , Li, A.\* , **Wu, B.\***, Fan, D., Triantafyllou, M. S., & Tang, D. (2021). Asymmetric vortex pair induces secondary traveling wave vibration of a flexible cylinder from still water to incoming flow. *Physics of Fluids*, 33(12), 125115.
- [3] Fan, D., **Wu, B.**, Bachina, D., & Triantafyllou, M. S. (2019). Vortex-induced vibration of a piggyback pipeline half buried in the seabed. *Journal of Sound and Vibration*, 449, 182-195.
- [4] Ji, C., Tan, P., **Wu, B.**. Hydrodynamics Research of Dual Oscillating Cylinders System of Side-By-Side Pattern in Still Water[J]. *Periodical of Ocean University of China*, 2019, 49(6): 104-112.

#### Conference

- [1] **Wu, B.**, Le Garrec, J., Fan, D., & Triantafyllou, M. S. (2017, June). Kill Line Model Cross Flow Inline Coupled Vortex-Induced Vibration. In *International Conference on Offshore Mechanics and Arctic Engineering* (Vol. 57649, p. V002T08A010). American Society of Mechanical Engineers.
- [2] Le Garrec, J., Fan, D., **Wu, B.**, & Triantafyllou, M. S. (2016, September). Experimental investigation of cross flow-inline coupled vortex-induced vibration on riser with finite length buoyancy module. In *OCEANS 2016 MTS/IEEE Monterey* (pp. 1-7). IEEE.

#### Pedagogy & education

- [1] **Wu, B.**, Aandahl, H. I., Bosneagu, R., Sæter, M., Cosofret, D., Avram, E.R., Zhang, H., and Li, G.: Survey for Interdisciplinary Co-supervision on Bachelor Thesis in Nautical Science. *EDUCON*, Kuwait, 2023. Submitted.

#### Academic Associate & Outreach

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##### IEEE | *Member*

**Feb. 2020 - Present**

- From Mar. 2022: Membership of the Intelligent Transportation Systems Society (ITSS), Vehicular Technology Society (VTS), Robotics and Automation Society (RAS), Systems, Man, and Cybernetics Society (SMC), and Education.

**2021 IEEE International Conference on Digital Twins and Parallel Intelligence** | *Session co-chair*    **Oct. 2022**

##### Reviewer

- Serve as a reviewer in the peer-review process of several international academic publications and conference proceedings, including *Marine Structure*, *IEEE Transactions on Intelligent Transportation Systems*, *Microelectronics Reliability*, *Polish Maritime Research*, and etc.

#### Technical Skills

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**Programming:** Python, MATLAB, html

**Frameworks/Softwares:** Windows/macOS/Linux, Git/GitHub, LaTeX, Adobe suite, AutoCAD, Unity3D

**Languages:** English (fluent), Chinese (native), Norwegian Bokmål (B1)