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CMHL COMPUTATIONAL MARINE HYDRODYNAMICS LAB
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# The 2nd Symposium on Computational Marine Hydrodynamics

## (The 2nd CMHL Symposium 2019)

## (第二届 CMHL 船舶与海洋工程计算水动力学专题研讨会)

**9:30-17:30, Wednesday, May 8, 2019**

**Mulan Building Room No. B808, Minhang Campus,**

**Shanghai Jiao Tong University**

**09:30-09:35 Opening Speech and Chair Prof. Decheng Wan**

**09:35-10:40 Plenary Lecture**

**Assessment of Computational Fluid Dynamic for Surface Combatant 5415 at Straight Ahead and Static Drift β =20 deg**

Prof. Frederick Stern, George D. Ashton Professor of Hydroscience and Engineering, University of Iowa, USA

**10:40-11:20 Keynote Presentation 1**

**Improving the Numerical Models for Wave Simulations and Its Application to Ship Breaking Waves**

Dr. Jianhua Wang, Shanghai Jiao Tong University

**11:20-12:00 Keynote Presentation 2**

**Numerical and Experimental Study of Point Absorber Wave Energy Converter**

Prof. Ye Li, Shanghai Jiao Tong University

**12:00-13:30 Lunch**

**13:30-14:10 Keynote Presentation 3**

**Block Structured AMR Method for the Simulation of Incompressible Flows**

Associate Prof. Cheng Liu, Shanghai Jiao Tong University

**14:10-14:50 Keynote Presentation 4**

**Numerical Simulation of Water Entry of a Bow-Fare Ship Section Using a Modified Ghost-Cell Immersed Boundary Method**

Prof. Xizheng Zhao, Zhejiang University

**14:50-15:30 Keynote Presentation 5**

**Numerical Investigation of Complex Liquid Sloshing Problems by Improved MPS Method**

Mr. Xiang Chen, Shanghai Jiao Tong University

**15:30-16:00 Tea Break**

**16:00-16:40 Keynote Presentation 6**

**Coupling High Order Spectral Method with CFD for Solving Container Ship in Steep Waves**

Ms. Yuan Zhuang, Shanghai Jiao Tong University

**16:40-17:20 Keynote Presentation 7**

**Numerical Simulation of Vortex-Induced Rotations of Column-Stabilized Floating Structures**

Dr. Weiwen Zhao, Shanghai Jiao Tong University

**17:20-17:30 Closing Ceremony Prof. Decheng Wan**

## Prof. Frederick Stern

Prof. Frederick Stern is internationally recognized expert in ship hydrodynamics: computational methods, modeling, wave basin, towing-tank and flume experiments; experimental/ computational uncertainty analysis/ quantification; and deterministic/ stochastic shape optimization. He has authored, co-authored, or edited: 7 international conference proceedings/ books; 6 book chapters; 5 committee reports and 12 Quality Manual Procedures for the 21st–25th International Towing Tank Conference; 22 NATO AVT final report chapters; 178 journal articles; 4 moderate review journal articles; 2 online archive articles; 249 conference proceeding papers, and 56 reports. Prof. Frederick Stern is chair of the Steering Committee of the International Workshop on CFD in Ship Hydrodynamics since 2015 and is also a permanent member of the SNH-ONR Paper Selection Committee since 2005.

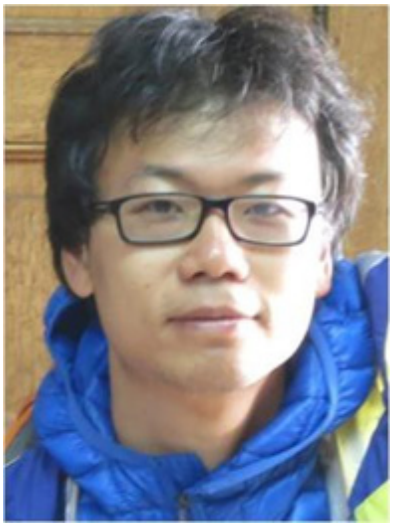
**Plenary Lecture: Assessment of Computational Fluid Dynamic for Surface Combatant 5415 at Straight Ahead and Static Drift β=20 deg**

Collaboration is described on assessment of computational fluid dynamics (CFD) predictions for surface combatant model 5415 at static drift b¼0 deg and 20 deg using recent tomographic particle image velocimetry (TPIV) experiments. Assessment includes Nversion verification and validation to determine the confidence intervals for CFD solutions/codes, and vortex onset, progression, instability, and turbulent kinetic energy (TKE) budget analysis. The increase in b shows the following trends. Forces and moment increase quadratically/cubically, and become unsteady due to shear layer, Karman and flapping instabilities on the bow. Wave elevation becomes asymmetric; its amplitude increases, but the total wave elevation angle remains same. The vortex strength and TKE increase by about two orders of magnitude, and for large b, the primary vortices exhibit helical mode instability similar to those for delta wings. Forces and moment for both band wave elevation for b¼0 deg are compared within 4% of the data, and are validated at 7% interval. Wave elevation for b¼20 deg, and vortex core location and velocities for both b are compared within 9% of the data, and are validated at 12% interval. The vortex strength and TKE predictions show large 70% errors and equally large scatter and are not validated. Thus, both errors and scatter need reduction. TKE budgets show transport of turbulence into the separation bubble similar to canonical cases, but pressure transport is dominant for ship flows. Improved CFD predictions require better grids and/or turbulence models. Investigations of solution-adaptive mesh refinement for better grid design and hybrid Reynolds-averaged Navier-Stokes/large eddy simulation models for improved turbulent flow predictions are highest priority.

## Prof. Xizeng Zhao

Dr Xizeng Zhao is Professor of Ocean College at Zhejiang University. He received his PhD degree in Port, Coastal and Offshore Engineering from Dalian University of Technology, Dalian China, in 2008. He has been working as a postdoctoral fellow from 2009 to 2011 in Research institute for applied Mechanics of Kyushu University, Japan. He was promoted to associate Professor in 2012 and then Professor in 2017 at Zhejiang University. He has over 110 publications in refereed journals and conference proceedings. His research has been mainly funded by the NSFC and his recent and current work focuses on Cartesian grid-based model development of extreme wave generation and nonlinear wave-structure interactions. He is an Editorial Board Member of Journal of Hydrodynamics and Chinese ocean Engineering.

## Prof. Ye Li



Dr. Ye Li is internationally recognized for his expertise in offshore renewable energy and for his extensive works in theoretical, numerical and experimental studies. He is a professor and founding Director of Shanghai Jiao Tong University (SJTU) Multiple Function Towing tank. He is an associate editor of ASME Journal of Offshore Mechanics and Arctic Engineering and AIP Journal of Renewable and Sustainable Energy. Prior to joining SJTU, he was a senior scientist at U.S. National Renewable Energy Laboratory (NREL) leading the ocean energy effort.

Wave energy is considered to be a very promising alternative energy resource nowadays. Since 2014 when Dr. Ye Li joined Shanghai Jiao Tong University (SJTU), he rapidly assembled a team to study it. In this talk, an overview of wave energy energy research in Dr. Li's team is given in numerical, theoretical and experimental aspects. More specifically, point absorber is presented as an example here. Finally, Dr. Ye Li will discuss the development of the multiple function towing tank at SJTU and share some future development plans.

## Associate Prof. Cheng Liu

Cheng LIU completed his doctorate at Kyushu University with a dissertation about an immersed boundary treatment for complex geometry and the interaction with free surface flow. Since then he worked as post-doctor and assistant professor in Research Institute for Applied Mechanics, Kyushu University, where he has specialized in computational hydrodynamics of floating offshore wind turbines and wake interaction analyzing of multiple current tidal turbines. In 2018, he joined the School of Naval Architecture, Ocean & Civil Engineering and worked as a tenure-track associate professor. The focus of his research is the development of adaptive mesh refinement strategy and its application in compressible multi-phase flow, compressible turbulence flow, incompressible flow and the interaction with rigid body, free surface flow with floating body and surface tension driven flow. His publication covers various aspect of computational fluid dynamics and hydrodynamics. Many of his recent works are online in refereed journals including Journal of Computational Physics, Computer Physics Communications, International Journal for Numerical Method in Fluid etc.

## Dr. Jianhua Wang

Dr. Jianhua Wang received his Ph.D. degree in 2018 in the school of Naval Architecture, Ocean & Civil Engineering in Shanghai Jiao Tong University. He is now an assistant professor in the department of Naval Architecture and Ocean Engineering, SJTU. His research interests are computational fluid dynamics, ship hydrodynamics, overset grids, ship hull-propeller-rudder interaction, ship maneuvering in waves, etc. Recently, he also conducted numerical investigations of breaking bow wave for high speed ships. He has published more than 20 journal and conference papers in the areas of ship hydrodynamics including ship resistance, seakeeping, self-propulsion, ship maneuverability, maneuvering in waves.

## Dr. Weiwen Zhao

Dr. Weiwen Zhao received his PhD degree from Shanghai Jiao Tong University (SJTU) in 2019. He is now a research associate in SJTU. His main research interest includes, computational hydrodynamics for marine structures, vortex-induced motions for column-stabilized floating structures, detached-eddy simulations, dynamic overset grids, high-order spectral nonlinear waves simulations, etc. Currently he is focused on the numerical simulations of vortex-induced motions and rotations for column-stabilized floating structures.

## Mr. Xiang Chen

Xiang Chen is a Ph.D candidate at school of Naval Architecture, Ocean & Civil Engineering, Shanghai Jiao Tong University. He is also a member of Computational Marine Hydrodynamics Laboratory since 2015. His research interest lies in the field of CFD investigations of violent nonlinear free surface flows including dam break, liquid sloshing, water entry, wave-structure interaction, etc. In addition, the numerical meshfree methods and acceleration techniques are also his study. Currently, he is working on the combination of Moving Particle Semi-implicit (MPS) method and GPU parallel acceleration technique in order to extend MPS method to large-scale three-dimensional problems.

## Ms. Yuan Zhuang

Phd candidate Yuan Zhuang, now work as a member of CMHL in Shanghai Jiaotong University, under the supervise of Professor Decheng Wan. Yuan Zhuang mainly works on the coupling effects of ship motion and sloshing tanks. The work has published with ‘Numerical Study on Ship Motion Fully Coupled with LNG Tank Sloshing in CFD Method’ on International Journal of Computational Methods. With one-year international communication in ECN, Nantes, the work on the coupled method with potential theory method (High Order Spetral Method) and CFD solver naoe-FOAM-SJTU is in progress.