上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

2023 International Summer School on Naval Architecture, Ocean Engineering and Mechanics

Program

Co-Organized by

船舶海洋与建筑工程学院
School of Naval Architecture, Ocean and Civil Engineering

SKLOE

Co-Supported by

Graduate School of Shanghai Jiao Tong University

Shanghai's Peak Discipline in Ship and Ocean Engineering

MINGYANG SMART ENERGY 明阳智能

CSSC 沪东中华造船(集团)有限公司 HUDONG-ZHONGHUA SHIPBUILDING (GROUP) CO.,LTD.

磁悬科技

July 23 - August 5, 2023

Shanghai, China

About Shanghai Jiao Tong University

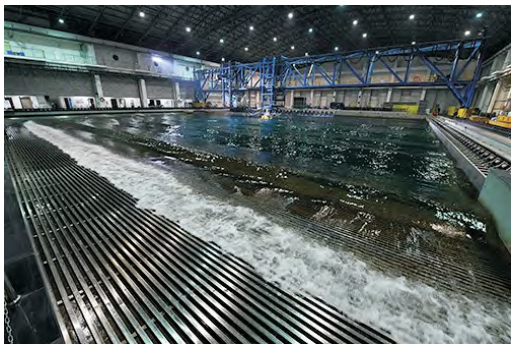
Shanghai Jiao Tong University is one of the famous institutions of higher learning with the longest history and reputation at home and abroad. It is a national key university directly under the Ministry of Education and jointly built with Shanghai Municipality. After 127 years of unremitting efforts, Shanghai Jiao Tong University has become a domestic first-class and internationally renowned university, and further defined the vision on constructing a "comprehensive, innovative and international" world-class university. SJTU has 33 schools/departments, 12 affiliated hospitals, 2 affiliated medical research institutes, 23 directly affiliated units and 5 directly affiliated enterprises, with 17,460 full-time undergraduates, 14,670 full-time master degree candidates, 11,031 full-time doctorate degree candidates, and 2,291 overseas students (among which 1,331 are postgraduates). SJTU faculty includes 3,512 full-time teachers (among which 1,157 are professors), 27 members of the Chinese Academy of Sciences, and 25 members of the Chinese Academy of Engineering. As a comprehensive university, SJTU offers 71 undergraduate programs covering 9 major disciplines: economics, law, literature, science, engineering, agriculture, medicine, management, and arts. SJTU insists on enhancing educational internationalization, constantly improving its comprehensive strengths and global influence, exploring a future-oriented internationalization strategy, speeding up the implementation of a new international development plan, expanding overseas layout, building overseas centers, deepening strategic cooperation, and promoting in-depth exchange visits so as to make steady progress towards the goal of establishing a world-class institution of higher education. Shanghai Jiao Tong University belongs to China, but more so, it belongs to the world.

上海交通大学 SHANGHAI JIAO TONG UNIVERSITY

船舶海洋与建筑工程学院
School of Naval Architecture, Ocean and Civil Engineering

About School of Naval Architecture, Ocean & Civil Engineering

In December 2003, School of Naval Architecture, Ocean & Civil Engineering (NAOCE) at Shanghai Jiao Tong University (SJTU) was founded by merging School of Naval Architecture and Ocean Engineering and School of Civil Engineering and Mechanics. There are four departments in the school of NAOCE, namely, Naval Architecture and Ocean Engineering, Engineering Mechanics, Civil Engineering and International Shipping. At present, the school offers five Bachelor degree programs, four Master degree programs and three PhD programs. Naval Architecture and Ocean Engineering and Mechanics offer PhD programs of fist-class disciplines and furnish Postdoctoral Research Stations. NAOCE houses State Key Laboratory of Ocean Engineering, features two state key disciplines, i.e., Design and Construction of Ship and Ocean Structures, and Engineering Mechanics; additionally, Fluid Mechanics as a key discipline in Shanghai. According to the SHANGHAI RANKING, the Naval Architecture and Ocean Engineering Program has ranked No.1 for many years.



2023 International Summer School on Naval Architecture, Ocean Engineering and Mechanics

Overview

Naval Architecture and Ocean Engineering covers a wide range of knowledge, and lays equal stress on both theory and practices. New concepts, new technologies and new methods on naval architecture and ocean engineering are continuously emerging. The Ocean Dreams International Summer School on Naval Architecture, Ocean Engineering and Mechanics provides a valuable opportunity for the students to learn from, to communicate with each other, to expand their fields of vision, and to have comprehensive understanding of naval architecture and ocean engineering. The "Ocean Dreams" International Summer School has been successfully organized for 14 sessions since 2009. Graduate students and senior undergraduates from the UK, Italy, Germany, Japan, South Korea and China enrolled in the summer school. Participants attended lectures given by specially invited distinguished experts and scholars from home and abroad, joined various outdoor professional practice and experienced culture activities.

Due to the Covid-19, the Summer School was held online in 2020-2022. This year, 2023 Summer School will be held onsite and continue to offer more than 20 high quality academic short courses and lectures in a wide range of subjects including the latest development of theory and application practices on naval architecture, ocean engineering and mechanics given by 20 specially invited experts and scholars from different parts of the world. A good number of both formal and informal academic discussions and poster seminars are scheduled as part of the summer school. Apart from the academic programs, we will also organize many social activities, including excursions, technical tours and social gatherings, which aims at providing a good platform for the participants to know the current trends of the subjects and to make good communication between students at home and abroad, promoting students' knowledge of Naval Architecture, Ocean Engineering and deep understanding of the culture of Shanghai Jiao Tong University, Shanghai and China.

上海交通大学 SHANGHAI JIAO TONG UNIVERSITY
船舶海洋与建筑工程学院 School of Naval Architecture, Ocean and Civil Engineering

Summer School Committee

Residium

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TIAN Xinliang

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YAN Zhimiao, LIANG Qingxue, LI Pengping, DONG Xiaoqian, ZHU Qianwen, GAO Yi, ZHANG Yuyang, HUANG Xiaoyu, CHEN Xing, JIANG Zhihao, ZHANG Huanyu, SUN Jingru

Volunteers

The Summer School Committee would like to express their gratitude to all the 2023 Summer School volunteers. The list of volunteers is as follows including contact information. If you have any questions, please contact them. We sincerely appreciate all the support they provide!

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Program at a Glance

July 23 – August 5, 2023

Day	Date	Event	Venue
1	**July 23 Sun**	**13:00-21:00** Registration	Ruth Mulan Chu Chao Building, Minhang Campus, SJTU
2	**July 24 Mon**	**8:00-8:30** Opening ceremony	**Chairman** Prof. CHEN Jinjian Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU
		8:30-10:00 Lecture 1 Prof. YAN Jun, Key Structural Mechanics Problems of Marine Energy Development Equipment **10:30-12:00 Lecture 2** Prof. GAO Zhen, An Introduction to Offshore Wind Turbine Technology **13:30-15:00 Lecture 3** Prof. TAO Longbin, A Single Point Mooring System for Operating in Offshore Wind Farms **15:30-17:00 Lecture 4** Prof. SHAO Yanlin, Slow-drift Motions of Offshore Structures and Mooring Design	**Chairman** Dr. CHENG Zhengshun Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU
3	**July 25 Tue**	**8:30-10:00 Lecture 5** Prof. ZHANG Jun, Can Fish form a Moving Crystal **10:30-12:00 Lecture 6** Prof. YUAN Zhiming, Wave Interference and Multibody Hydrodynamics	**Chairman** Dr. ZHANG Xiantao Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU

		13:30-15:00 Lecture 7 Prof. LUO Yong, Offshore Mooring Systems for Floating Systems **15:30-17:00 Lecture 8** Prof. ZHANG Xinshu, Freak Waves in Crossing Sea Conditions	
		18:00-20:00 Welcome dinner	Academic Center, Minhang Campus, SJTU
4	**July 26 Wed**	**9:00-12:00** Visiting Minhang Campus **13:30-17:00** Visiting SKLOE	Minhang Campus, SJTU
5	**July 27 Thu**	**8:30-10:00 Lecture 9** Prof. HUANG Weixi Vortex Dynamics and Lift/Thrust Generation Mechanism of Flying and Swimming **10:30-12:00 Lecture 10** Prof. ZHENG Zhong, Some Aspects on Energy and Environmental Flows: Gravity Current, Unsaturated Flow, and Hydraulic Fracturing **13:30-15:00 Lecture 11** Prof. WAN Decheng, Computational Marine Hydrodynamics (CMH): Perspectives and Prospects **15:30-17:00 Lecture 12** Prof. ZHOU Li, Ice Resistance	**Chairman** Dr. WANG Jianhua Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU
6	**July 28 Fri**	**8:30-10:00** Visiting Xuhui Campus	Xuhui Campus, SJTU

		10:30-12:00 Visiting Qian Xuesen Library & Museum **14:00-17:00** Visiting the YUANWANG 1 Research Vessel	**YUANWANG 1:** No. 98 Longhua East Road, Huangpu District, Shanghai
7	**July 29 Sat**	**8:30-10:00 Lecture 13** Prof. CUI Weicheng, Challenges to the Frontiers of Science and Technology in the Development of Biomimetic Intelligent Robotic Fish-type Submersibles **10:30-12:00 Lecture 14** Prof. ZONG Zhi, Phase Transformations in Ship Ice-Dynamics **13:30-15:00 Lecture 15** Prof. XING Jingtang, Numerical Methods for Linear and Nonlinear Fluid-Structure Interaction Dynamics with Applications in Engineering **15:30-17:00 Lecture 16** Prof. LI Zhijun, The Principles of Sea Ice Parameter Determine in Marine Engineering Plan, Design and Operation	**Chairman** Dr. LI Fang Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU
8	**July 30 Sun**	Free Activities	
9	**July 31 Mon**	**8:30-10:00 Lecture 17** Dr. MITSUYUKI Taiga, Digitalization and Digital Twin Activities in maritime Industry **10:30-12:00 Lecture 18** Prof. ZHENG Ming, Carbon Neutral Propulsion – Challenge and Viability	**Chairman** Dr. CHEN Run Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU

		13:30-15:00 Lecture 19 Prof. QIAO Pizhong, Novel Joint Deformation Models for Interface Mechanics and Fracture of Laminated Composite Structures **15:30-17:00 Lecture 20** Prof. WANG Jin, Spar Platform Technology – Past, Present and Future	
10	**Aug 1 Tue**	**8:30-17:00** Visiting the Shipyards	Hudong-Zhonghua Shipbuilding (Group) Co., Ltd.
11	**Aug 2 Wed**	**8:30-17:00** Experimental Training (Mechanics)	Engineering Mechanics Experimental Center, Minhang Campus, SJTU
12	**Aug 3 Thu**	**8:30-17:00** Experimental Training (Ocean Engineering)	State Key Laboratory of Ocean Engineering, etc., Minhang Campus, SJTU
13	**Aug 4 Fri**	**8:30-11:30** Student Presentation **13:30-14:00** Poster Session and Discussion **16:00-17:00** Closing Ceremony	**Student Presentation:** Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU **Poster Exhibition:** The 1st Floor Lobby, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU **Closing Ceremony:** Great Hall A100, 1F, Ruth Mulan Chu Chao Building, Minhang Campus, SJTU
14	**Aug 5 Sat**	End of the Summer School, Participants Leaving	

Introduction to the Lectures

YAN Jun

Lecture 1: Key structural mechanics problems of marine energy development equipment.

Time: Monday, July 24 8:30-10:00

Abstract:

With the increasing depth of ocean development, underwater production systems have become one of the important technical means for economical development of deep-sea and offshore marginal oil and gas fields. Umbilical cables and flexible risers serve as key equipment in underwater production systems, known as the "lifeline" of marine energy development. However, the environment in deep sea is extremely harsh, it is important to conduct mechanical analysis, structural optimization, and design of cable and riser structures. This report will introduce the integrated design and industrialization of domestic umbilical cable, key technologies of flexible risers and accessories, field monitoring of marine equipment and digital twin technology, and structural innovative design and topology optimization.

Biography:

YAN Jun, professor of computational mechanics at Dalian University of Technology, the Changjiang Distinguished Professor, serves as the vice chairman of Liaoning Mechanical Society. After receiving his PHD degree from Dalian University of Technology, he specializes in the fields of structural and multidisciplinary optimization design and structural design/testing of Umbilical cable/ flexible risers in offshore engineering, and devotes to the application of artificial intelligence technology to ocean engineering. He has published 58 peer reviewed journal papers and authorized 16 patents.

Introduction to the Lectures

GAO Zhen

Lecture 2: An introduction to offshore wind turbine technology

Time: Monday, July 24 10:30-12:00

Abstract:

In this lecture, an overview of the development of offshore wind turbines with different bottom-fixed and floating foundations will be delivered first, followed by a brief introduction to the basic theories related to wind turbine aerodynamics (with focus on BEM – Blade Element Momentum theory), hydrodynamics (both Morison's formula and potential flow theory) as well as coupled dynamic response analysis of offshore wind turbines for operational and survival conditions. Response characteristics of typical wind turbines (monopile, jacket, spar, semi-submersible and TLP) in simultaneous wind and wave conditions will be discussed in detail. A review of the recent research work and challenges related to large-scale (15MW+) offshore floating wind turbines will be presented at the end.

Biography:

GAO Zhen, is a full professor at Shanghai Jiao Tong University. He was a professor at Norwegian University of Science and Technology between 2015 and 2022. He is a member of the Norwegian Academy of Technological Sciences (NTVA) since 2020. He has been working on the research projects and educational programs in the areas of offshore renewable energy (with focus on offshore wind turbines and wave energy converters), marine operations related to installation of marine structures, stochastic load and response analysis for offshore platforms. He is an associate editor for Journal of Marine Structures, Journal of OMAE. He was the chairman for the Specialist Committee on Offshore Renewable Energy at ISSC from 2012 to 2018. By June 2023, he has published 240 peer-reviewed papers, including 145 journal papers. His Google Scholar H-index is 49 with a total citation of 7082.

Introduction to the Lectures

TAO Longbin

Lecture 3: A single point mooring system for operating in offshore wind farms

Time: Monday, July 24 13:30-15:00

Abstract:

This project is to develop and validate a numerical model of a recently proposed single point mooring system (SPMS) set-up and resulting loads on the mooring system based on load measurements taken during the sea trial campaign by our industry partner (O.S. Energy UK). Following validation, further investigation of the mooring behaviour and loads on the offshore wind turbine structures in a range of representative environmental conditions are conducted, including the combined effects of wind, waves and current to determine an appropriate limit state and operational envelope for the sub-sea survey/inspection work to be carried out safely.

Biography:

Longbin Tao received his PhD from The University of Western Australia in 2002 for research on offshore hydrodynamics. He joined the Department of Naval Architecture, Ocean & Marine Engineering at University of Strathclyde October 2017. Previously, he had held the Lloyd's Register Chair Professor of Offshore Engineering at Newcastle University from 2009 to 2017. Before moving to the UK, he lectured at Griffith University in Australia from 2001 to 2008. Longbin's primary research interests are in coastal and offshore hydrodynamics with applications in marine resource development. Prior to an academic career, he was employed as an engineer at Maritime Safety in China and naval architect at a shipbuilding company in Australia.

Introduction to the Lectures

SHAO Yanlin

Lecture 4: Slow-drift motions of offshore structures and mooring design

Time: Monday, July 24 15:30-17:00

Abstract:

Mooring system is the most popular station-keeping system for floating offshore structures. This lecture starts with an introduction of mooring systems, design consideration and some important learning from a joint industry project (JIP) related to mooring integrity. Large-amplitude slow-drift motions in the horizontal plane, one of the main reasons of excessive mooring loads, will be explained with idealized and industrial examples. The state of the art in modelling the slow-drift motions, existing challenges and dilemma, and needed future research are discussed.

Biography:

SHAO Yanlin is an associate professor and Head of Studies of Nordic Master in Maritime Engineering program at Technical University of Denmark (DTU). He received a PhD in marine hydrodynamics from Norwegian University of Science and Technology (NTNU) in 2010. He has worked as a senior hydrodynamic engineer in DNV, and in Sevan Marine as a lead mooring engineer for the Shell Penguins FPSO project. His main research interests are in the modeling of ocean waves and their interaction with manmade and natural structures in the ocean. He has authored more than 90 publications in computational physics/methods and his field, and serves as an associate editor for ASME Journal of Offshore Mechanics and Arctic Engineering.

Introduction to the Lectures

ZHANG Jun

Lecture 5: Can fish form a moving crystal

Time: Tuesday, July 25 8:30-10:00

Abstract:

For a long time, researchers on animal locomotion have suspected that fish individuals might take a regular formation in order to save effort when they swim close to each other. In such formation, each fish takes up one spot in a lattice. However, such “fish crystal” was never observed in the real world. Some claimed that the hydrodynamic interactions are too weak to establish such formations. We found, through experimental studies, that the reason is quite the opposite. The pair-wise interactions are significant, leading to many “locking positions (fixed separations)” between two swimming individuals. For a fish school of many individuals, there exists too many stable separations but not a single one between them, destroying a possible regular formation of them.

Biography:

ZHANG Jun's research interests lie in the field of physics of fluids and complex systems, which include biomechanics or bio-locomotion (organismal swimming and flying), geophysical fluids (thermal convection, continental dynamics, and erosion), nanomotor locomotion, urban heat-island effect, and self-organization phenomena at different scales. He leads a research group at NYU Shanghai and also serves as the co-director of the Applied Math Lab at the Courant Institute, and has been elected as a Fellow of the American Physical Society.

Introduction to the Lectures

YUAN Zhiming

Lecture 6: Wave Interference and Multibody Hydrodynamics

Time: Tuesday, July 25 10:30-12:00

Abstract:

In our daily life, we can observer the wave interference everywhere. In a river or lake, a duck/ship moving forward will generate the Kelvin waves, which may interact with the other ducks/ships in the river, resulting in unsteady interference. In the swimming pool, when two simmers are overtaking or encountering each other, wave interference also occurs, leading to energy saving strategies by competition swimmers. In ocean engineering, the radiation waves generated by wave energy converter arrays will also have complex interference. In this seminar, I will introduce my recent work, covering all the above-mentioned wave interference phenomenon and trying to draw some lessons for naval architects and ocean engineers.

Biography:

Dr. YUAN Zhiming has been a Lecturer (Assistant Professor, 2015-2019), then a Senior Lecturer (Associate Professor, 2019 - 2022), and then a Reader (2022 -) in the Department of Naval Architecture, Ocean and Marine Engineering at the University of Strathclyde. His research activity mainly focused on the Marine Hydrodynamics and Offshore Renewable Energy, and he has published more than 70 peer-reviewed journal articles on these areas. Dr Yuan is currently acting as the Deputy Editor of Ocean Engineering, and the Scientific Managing Editor for Ocean Engineering, Applied Ocean Research, Coastal Engineering and Marine Structures, Associate Editor of Frontiers in Energy Research and editor board member of several international journals. He is an ITTC committee member, sectary, and executive chair of ITTC Maneuvering Committee. He is currently leading the Hydrodynamics and Ocean Renewable Energy Laboratory (HOREL) at Strathclyde. His research work on wave interference has been selected as Focus on Fluids article by Journal of Fluid Mechanics, and highlighted by Nature (Nature. 565(7741):538), and been widely reported by TheTimes, DailyMail, Today Headline, ScienceNews, etc. Dr Yuan is a Ig Nobel Prize Holder, shared the 32nd Ig Nobel Prize in Physics.

Introduction to the Lectures

LUO Yong

Lecture 7: Offshore Mooring Systems for Floating Systems

Time: Tuesday, July 25 13:30-15:00

Abstract:

The lecture starts by introducing the history and background of offshore moorings. It then describes the types of mooring systems, including a comparative evaluation of their performance and their range of applicability. Having introduced the basics about the mooring systems and the loads acting on them, the mooring design approach and analysis methodologies are presented. The analysis methods cover system statics, dynamic responses, and fatigue behavior. Model tests are normally an important part of the design process, and the modern model tests technics are introduced. Finally, the mooring system hardware, the installation and maintenance aspects are discussed. The objective of the lecture is to give students a broad overview of the offshore mooring systems including their functionalities, design and operation.

Biography:

Yong Luo is a visiting professor at Shanghai Jiao Tong University. He graduated from Shanghai Jiao Tong University with a bachelor's degree and a doctorate in naval architecture and ocean engineering from UK in 1991. Over 30 years experience in the offshore oil and gas industry with extensive experience in the design and analysis of offshore floating production systems. Held key managerial and technical positions with engineering consultancy company, Class Society and large EPC contractors. Led many deepwater field development projects utilizing floaters including FPSO's, Tension Leg Platforms (TLP), semi-submersibles and other floating structures. Authored two engineering books and more than 60 technical papers on floating structures, hydrodynamic analysis, mooring and riser system designs, risk analysis and field development concepts.

Introduction to the Lectures

ZHANG Xinshu

Lecture 8: Freak Waves in Crossing Sea Conditions

Time: Tuesday, July 25 15:30-17:00

Abstract:

For hundreds of years, massive waves in the open ocean—called rogue waves or freak waves—were thought only to be maritime legend. These waves pose a significant risk to ships and maritime structures because of their massive size and force, but they remain difficult to predict. We have proposed a novel method to quickly forecast the occurrence and shape of rogue waves in specific conditions. A series of direct numerical simulations of the potential Euler equation are performed using a higher-order spectral (HOS) method to investigate the nonlinear statistics and freak waves occurrence in crossing sea states. Several different crossing sea states with varying frequency spectra, directional spreading, and crossing angles between two wave components are chosen for the computations. The dynamical statistics of surface waves are reported, including the wave spectra, the exceedance probability of wave crest amplitude, the probability density distribution of surface elevation, the kurtosis and skewness, freak wave occurrence probability, and the freak wave shape. Furthermore, a new Benjamin-Feir index is derived to measure the third-order nonlinearity effects for crossing seas. This parameter allows us to forecast the probability of freak waves.

Biography:

ZHANG Xinshu is a professor at Shanghai Jiao Tong University. He obtained his BS and MS degrees in Naval Architecture and Ocean Engineering from Shanghai Jiao Tong University and earned a PhD in Marine Hydrodynamics from University of Michigan at Ann Arbor. His research interests include nonlinear wave-wave and wave-body interactions, with particular focus on phase-resolved wave field prediction. He has authored or co-authored more than 40 SCI papers on JFM, PRF, POF and other journals. He also serves as a technical committee member in ITTC since 2016, and works for Journal of OMAE and Ocean Engineering as Associate Editor and Editorial member.

Introduction to the Lectures

HUANG Weixi

Lecture 9: Vortex Dynamics and Lift/Thrust Generation Mechanism of Flying and Swimming

Time: Thursday, July 27 8:30-10:00

Abstract:

To improve the performance of UUV and MAV, it is important to understand the flying and swimming mechanisms. This talk first reviews the research hotspots of flying and swimming in recent years. Since such problems bring a big challenge in numerical methods, a brief introduction to the immersed boundary method is given. Furthermore, recent progresses in mosquito flight, tuna swimming and batoid swimming, as typical examples, will be presented. Evolution and interaction of specific vortical structures, and their quantitative contributions to the lift/thrust generation, are illustrated, with the purpose of disclosing the secrets of flying and swimming in nature.

Biography:

Dr. HUANG Weixi is currently a full professor in School of Aerospace Engineering at Tsinghua University. His research focus is on numerical study of turbulent flows on the complex boundaries. Prof. Huang is also interested in computational biofluid mechanics. He has been developing computational methods for fluid-flexible body interactions, with the goal of simulating and obtaining physical insight into problems from biomechanics. Prof. Huang received the National Natural Science Fundation of China for Excellent Young Scientists in 2013. He is now the associate editor of Journal of Mechanical Science and Technology, and Proc. Inst. Mech. Eng.-Part C: Journal of Mechanical Engineering Science. He is also in the editorial boards of International Journal of Heat and Fluid Flow, Journal of Hydrodynamics, and Theoretical and Applied Mechanics Letters.

Introduction to the Lectures

ZHENG Zhong

Lecture 10: Some aspects on energy and environmental flows: Gravity current, unsaturated flow, and hydraulic fracturing

Time: Thursday, July 27 10:30-12:00

Abstract:

In this lecture, we present theoretical, numerical and experimental investigations on three mechanics problems, partly inspired by the practice of geological CO2 sequestration, enhancing oil recovery, and the technology of hydraulic fracturing. (i) We first study the spreading dynamics of a gravity current in a confined porous layer, with an emphasis on the time transition from early-time unconfined towards late-time confined flows and the role of viscosity ratio in selecting the flow pattern. This work is then extended to study the interaction of two gravity currents and the flow is now also under the influence of the buoyancy ratio and flow-rate partition. (ii) To look further into the role of wetting and capillary effects, we present a united theory for gravity current, interfacial and unsaturated flows, and the flow is now under the influence of the viscosity ratio, pore-size distribution, and an effective capillary number that measures the competition between the buoyancy and capillary forces. (iii) Finally, we introduce a scaling theory and experimental observations on the dynamics of hydraulic fractures in elastic solids. In particular, we discuss two distinct fracturing regimes when the dominant resistance for hydraulic fracturing is viscous drag or crack-tip opening.

Biography:

Zhong Zheng joined Shanghai Jiao Tong University in 2020 as an associate professor with tenure and later obtained an Eastern Scholar Fellowship as professor of special appointment at Shanghai Institutions of Higher Learning. He obtained a bachelor's degree from Tsinghua University and later a PhD degree from Princeton University. He then took research and teaching positions at Princeton and Cambridge Universities. His research interest is fluid mechanics, transport phenomena, flow-structure interaction, and their applications to grand challenges facing the society, such as those impact the energy and environmental system, global climate change, and human health. He has published some 40 papers in leading journals such as ARFM, JFM, PNAS, and PRL.

Introduction to the Lectures

WAN Decheng

Lecture 11: Computational Marine Hydrodynamics (CMH): Perspectives and Prospects

Time: Thursday, July 27 13:30-15:00

Abstract:

In this presentation, the history and motivation of development of Computational Marine Hydrodynamics (CMH) techniques for ship and ocean engineering flows are introduced first. Then, several CMH solvers for marine hydrodynamics, including naoe-FOAM-SJTU and MLParticle-SJTU, are taken as examples to explain how to develop an efficient and reliable CMH tool for marine hydrodynamics. Finally, the future of CMH techniques is drawn to show the bright prospects of CMH and the creative thinking is required to push CMH forward.

Biography:

Prof. WAN Decheng is Head of Computational Marine Hydrodynamics Laboratory (CMHL, http://dcwan.sjtu.edu.cn/) at SJTU, distinguished professor of Chang Jiang Scholar and Shanghai Eastern Scholar, the chair of ISOPE International Hydrodynamic Committee, Advisor committee member of International Towing Tank Conference (ITTC), associate editor-in-chief of Journal of Hydrodynamics, editorial board member of Ocean Engineering and Applied Ocean Research, etc. Prof. Wan has been selected as TOP 2% scientists from all over the world since 2020. He is awarded the most cited researchers since 2018 by Elsevier, received CH Kim Award, ISOPE Award, Best paper of Moan-Faltinsen Award, etc. His research interest is mainly on computational marine and coastal hydrodynamics, fluid-structure interaction, offshore wind turbine and other offshore renewable resources, etc. In these areas, he has published over 580 papers, has delivered over 100 invited or keynote presentations.

Introduction to the Lectures

ZHOU Li

Lecture 12: Ice Resistance

Time: Thursday, July 27 15:30-17:00

Abstract:

Ice resistance calculation is crucial to polar ship operation and design. Different from ordinary ship, polar ship is subject to ice load when navigating in ice-infested waters. Compared to calm water resistance, ice resistance is much high, which is always dominant environmental load for polar ship. In this lecture, we will introduce the fundamental knowledge on level ice, summarize some ice resistance methods that commonly used, and then show some numerical and experimental methods for predicting dynamic ice load and ice resistance.

Biography:

ZHOU Li is a full professor at Shanghai Jiao Tong University with major in Naval Architecture and Ocean Engineering. He obtained PhD degree from Norwegian University of Science and Technology in 2009 and worked in Aker Solutions from 2013 to 2017. He mainly focuses on Ice engineering, including numerical simulation of ice load, design of polar ship and offshore structures, ice-propeller interaction, marine control. He has published more 100 papers in MAST, OE, CRST, and so on.

Introduction to the Lectures

CUI Weicheng

Lecture13: Challenges to the frontiers of Science and Technology in the Development of Biomimetic Intelligent Robotic Fish-type Submersibles

Time: Saturday, July 29 8:30-10:00

Abstract:

The exploration, research and exploitation of marine resources cannot be separated from deep-sea submersibles. The development of deep-sea submersible technology has gone through two generations, and the second generation manned and unmanned submersibles have achieved operations at all depths and seas, but the current operational cost is very high. If we want to significantly improve the performance of submersibles and reduce costs, we need to learn from marine fish. The development of the third generation biomimetic intelligent robotic fish type submersible is an inevitable trend. In this report, I will first introduce the role and status of submersibles in deep-sea exploration, as well as the division of three generations of submersible technology. Then, I will present the key technical issues in the development process of the third-generation biomimetic intelligent robotic fish type submersibles. Finally, I will discuss some new challenges to scientific theory in the development of biomimetic intelligent robotic fish type submersibles.

Biography:

Dr. CUI Weicheng, Currently, he is a Chair professor at Westlake University. He got his B.Sc from Department of Engineering Mechanics of Tsinghua University in 1986 and his PhD from University of Bristol, England, in 1990. From 1990 to 1993, he did his post-doctorate research in the Department of Aerospace Engineering of University of Bristol. From February 1993 to May 1999, he worked in China Ship Scientific Research Center (CSSRC) and from June 1999 to September 2002 he was appointed as the Changjiang Professor of Shanghai Jiao Tong University and from October 2002 to March 2013 he was working in CSSRC again. From March 2013 to September 2018, he was working at Shanghai Ocean University and from September 2018 onward, he was working at Westlake University. He was the project leader and first deputy chief designer of Jiaolong deep manned submersible. He is a member of the editorial board of six international journals and several national journals. He has published more than 400 technical papers in various technical journals and conferences. His current interest is to develop robotic fish type manned/unmanned submersibles in order to promote the development of ocean science and environmental protection.

Introduction to the Lectures

ZONG Zhi

Lecture 14: Phase Transformations in Ship Ice-Dynamics

Time: Saturday, July 29 10:30-12:00

Abstract:

A brief introduction is first given in this lecture of Geometric Phase Transformation (GPT) followed by description of complicated mechanical properties of sea ice and ship-ice interaction. In the third part, applying GPT concept, together with Random Pore Model (RPM), reproduces mechanical properties that sea ice shows. Applying the concept to ship-ice interaction simplifies ship resistance analysis in brash ice, helping us classify ship resistance in brash ice into two parts depending on if the random ice field is in the discrete or connected phases. This provides a new technique to analyze model experiments of ship resistance in brash ice.

Biography:

ZONG Zhi is a professor at Dalian University of Technology. He graduated from Hiroshima University with a Doctorate of Engineering in naval architecture and ocean engineering in 1995. His research interests include underwater explosion, ship and marine hydrodynamics, computational mechanics and ship ice-dynamics. He has authored seven monographs and published 200 over SCI papers. He has taught courses on Shock and Vibration, Fluid Mechanics, Ocean Engineering Environmental Conditions, Ship Resistance and Propulsion, Computational Fluid Mechanics, and Computational Methods for under- and post-graduates.

Introduction to the Lectures

XING Jingtang

Lecture 15: Numerical Methods for Linear and Nonlinear Fluid-Structure Interaction Dynamics with Applications in Engineering

Time: Saturday, July 29 13:30-15:00

Abstract:

This presentation starts from a short introduction on the characteristics of fluid-solid interaction dynamics with important problems in engineering, and then gives some developments of numerical methods for linear and nonlinear fluid-structure interactions (FSI) with their applications in engineering, which mainly contributed by him and his collogues / students in about the past 30 years. The discussions cover the four numerical models:

（1) mixed finite element (FE)-substructure-subdomain approach to deal with linear incompressible / compressible FSI involving sloshing / acoustic / explosion waves in fluids;

（2) mixed FE-boundary element (BE) model to solve linear water-structure interactions with infinite fluid domain;

（3) mixed FE-finite difference (FD) model for nonlinear FSI problems but no separations between fluids and solids;

（4) mixed FE-smooth particle method (SPM) to simulate nonlinear FSI problems with f-s separations as well as breaking waves.

The partitioned approach is suggested in base of available fluid and solid codes to separately solve the governing equations of fluid and solid and then to forward step by step through iteration until reached convergence. The selected application examples include air-liquid-shell interactions, LNG ship-water sloshing dynamics; acoustic simulation of air-building interaction system excited by human foot impacts; aircraft landing impacts on water-VLFS interaction system; turbulence flow-body interactions; breaking wave simulations for structure-fluid interactions, etc. The numerical results are compared with the experiment results or numerical data provided by the publications to demonstrate the discussion approaches.

Biography:

Professor XING Jingtang is a tenured emeritus professor of at the University of Southampton. He is a chartered mathematician of Institute of Mathematics & Applications, UK, official membership of ASME Fluid Structure Interaction Technical Committee, USA, member of International Institute of Acoustics & Vibration, and member of Chinese Society of Vibration Engineering, Chinese Society of Theoretical & Applied Mechanics, and Chinese Society of Aeronautics. Professor Xing is an internationally renowned expert in applied mechanics. He has made important contributions recognized by the world in the fields of fluid–structure interaction dynamics, variational principle and application of dynamics, energy flow analysis of vibration systems, and dynamics of complex coupling systems and vibration control. He is also a highly experienced expert in experimental mechanics, dedicated to the research of theoretical and applied mechanics for a long time. He has participated in multiple aircraft structural resonance tests as a technical supervisor, and has decades of experience in aviation structural dynamics and testing. He has rich experience and theoretical research in structural dynamic testing of large aircraft. Professor Xing has led and completed multiple research projects, including the National Natural Science Foundation, the European Community, and the Royal Fund of the United Kingdom. His achievements have received widespread attention and recognition from the international academic community.

Introduction to the Lectures

LI Zhijun

Lecture 16: The principles of sea ice parameter determine in marine engineering plan, design and operation

Time: Saturday, July 29 15:30-17:00

Abstract:

Ice features and parameters are used in ice engineering. Except the sea ice, river ice, lake (reservoir ice) have the different engineering usages with the obviously different ice properties and structures, the sea ice features and properties also have different selection principle with different engineering aims or in different stage of same aim. If you have already obtained the ice feature and properties, how can you select the parameters as the used parameters in plan, design and operation? This lecture uses the fixed structures and ships as examples to explain the different selection principle in different stage with a set of sea ice feature and mechanical data.

Biography:

LI Zhijun is a professor at State Key Laboratory of Coastal and Offshore Engineering, Dalian University of Technology. He graduated from Hebei College of Geology with a bachelor's degree in 1982, obtained his master degree and PhD from Lanzhou Institute of Glaciology and Geocryology, Chinese Academy of Sciences in 1982, and 1993 Mainly engaged in the scientific research and teaching of ice physical and mechanical properties, ice engineering and polar ice science and technology. His research interests include field investigations, laboratory measurements and physical modelling experiments on ice features, properties and ice loads on structures. He has published more than 100 SCI papers, and authorized 8 patents.

Introduction to the Lectures

MITSUYUKI Taiga

Lecture 17: Digitalization and Digital Twin Activities in maritime industry

Time: Monday, July 31 8:30-10:00

Abstract:

In the maritime industry, monitoring technology has been applied on a trial basis for about ten years. Many examples of rational performance management use monitoring data for individual components such as marine engines. However, it is challenging to realize performance management of required functions of entire complex systems like ship and shipbuilding processes using limited monitoring data. For example, the performance of a ship is evaluated by indicators such as propulsive performance, structural integrity, and maneuverability. Nevertheless, these performance indicators' value fluctuates and changes significantly depending on the operating conditions and the surrounding environment, such as the operation area. Otherwise, the shipbuilding process is a large and complex project involving a large percentage of highly technical work done by human workers. The progress of each human work is unstable, and there are many reworks and troubles in the shipbuilding process. In this situation, rational project management has not been possible.

To deal with the above problems, we are studying the digital twin approach for rational management in ship operation and shipbuilding processes. Specifically, this lecture will introduce ongoing research activities on how the series of loops of simulation, monitoring, and system identification can be conducted in ship operation and shipbuilding. Through these case studies, we will discuss the important key issues to realize effective digital twin management in complex systems.

Biography:

MITSUYUKI Taiga received his PHD from The University of Tokyo in 2014 for research on systems engineering. From 2014 to 2018, he was an assistant professor at The University of Tokyo Since 2018, he has been an associate professor in Yokohama National University. From 2021, he has been a vice director of Typhoon Science and Technology Research Center (TRC) at Yokohama National University. His research interests include systems engineering and design engineering around the area of naval architecture and ocean engineering.

Introduction to the Lectures

ZHENG Ming

Lecture 18: Carbon Neutral Propulsion – Challenge and Viability

Time: Monday, July 31 10:30-12:00

Abstract:
Future propulsion systems are governed by their environmental impacts, energy sustainability, conversion efficiency, and safety compliance. In order to meet the demand of payload capacity and traveling range, energy sources with high energy density are often preferred. Hereby, fundamental data, and application practices, are illustrated to reveal the potential and limits of all viable energy sources. For marine application, clean and efficient combustion of low and zero carbon fuels remains to be the most promising technical path to realize carbon neutral transportation, without significantly sacrificing the performance of the propulsion system. Challenge remains in realizing complete combustion of renewable fuels with low chemical reactivity, such as ammonia. Reactivity modulation and effective ignition strategy can support robust ignition and combustion control.

Biography:
Dr ZHENG Ming is a Professor, NSERC/Ford Industrial Research Chair in Clean Combustion Engine Innovations at the Department of Mechanical, Automotive & Materials Engineering of the University of Windsor, and a SAE Fellow. He also served as a two-term Canada Research Chair from 2003-2013 in Clean Diesel Engine Technologies and the Director of Clean Combustion Engine Research group. He received his PHD in 1993 from University of Calgary; NSERC-JSPS Postdoctoral Fellow 1995 from Hokkaido University, and MSc in 1988 from Tsinghua University. Dr. Zheng has expertise in high efficiency engine development, advanced ignition control, combustion diagnostics, engine dynamic modeling, fuel management, adaptive combustion control, emission control, and biofuel engines. He has developed a sophisticated real-time control system with field programmable gate array (FPGA) to implement model-based combustion strategies. His investigations in reactively-controlled and dual-fuel combustion have led to two patents on a dual-bowl piston design and a time-shared air management system. He has led studies in high-power ignition and control resulting in 15 patent applications, i.e., the multi-coil high energy spark ignition and the corona ignition systems. He has invented the active after-treatment strategies of dynamic thermal management and continuous space-sharing regeneration with three patents on a variety of active flow control converters for the exhaust after-treatment of internal combustion engines.

Introduction to the Lectures

QIAO Pizhong

Lecture 19: Novel Joint Deformation Models for Interface Mechanics and Fracture of Laminated Composite Structures

Time: Monday, July 31 13:30-15:00

Abstract:

Split beam type of fracture specimens is commonly used in the delamination evaluation of laminated composites, and the compliance and energy release rate (ERR) of the specimens are examined in the new light of the crack tip deformation. Three joint deformation models (i.e., the rigid, semi-rigid and flexible joint models) describing the different degrees of crack tip deformation are introduced based on three corresponding bi-layer beam theories (i.e., the conventional composite beam, shear deformable bi-layer beam, and interface deformable bi-layer beam). Due to different considerations of the interface displacement compatibility in each bi-layer beam theory, these joint models, among which the semi-rigid and flexible joint ones are developed by the speaker's group, show three distinct levels of accuracy in predicting the crack tip deformation. By using these two novel joint models, the new terms, which are “missing” in the rigid joint model, are recovered for the compliances and ERRs of six common delamination specimens. The novel semi-rigid and flexible joint deformation models provide explicit closed-form solutions of fracture parameters which can be easily adopted in practice, thus contributing to advancing linear elastic fracture mechanics of bi-layer interface and laminated composite structures. Potential challenges and feasible solutions facing the interface mechanics and fracture are further discussed.

Biography:

Dr. QIAO Pizhong, currently “Zhiyuan” Chair Professor, Shanghai Jiao Tong University (SJTU). Before joining SJTU, he is a Professor of Civil and Environmental Engineering, Washington State University (WSU) and Founder of Integrated Smart Structures, Inc. He is a registered professional engineer (PE) in Structural Engineering and certified in the practice of structural engineering from Structural Engineering Certification Board (SECB). He was named a Fellow of the American Society of Civil Engineers (ASCE) in 2007 and elected to a Fellow of Engineering Mechanics Institute (EMI), ASCE in 2017. He has been extensively working in development, research and application of advanced and high performance materials (smart materials, polymer composites, and sustainable concrete) in civil and aerospace engineering. His research interest includes Analytical and Applied Mechanics, Smart and Composite Materials, Interface Mechanics and Fracture, Impact Mechanics and High Energy Absorption Materials, Structural Health Monitoring, Integrated Intelligent Structural Systems, Materials Characterization, and Sustainable Concrete. His extensive publication record includes more than 500 technical publications of which about 250 are the published peer-reviewed journal articles of international circulation.

Introduction to the Lectures

WANG Jin

Lecture 20: Spar Platform Technology – Past, Present and Future

Time: Monday, July 31 15:30-17:00

Abstract:

Spar platform technology is one of the key technologies currently used in the offshore industry for deepwater oil production and wind power generation. The first Spar platform was installed in the Gulf of Mexico for oil production in 1997 and there are now 22 deepwater oil Spar platforms in the world. In 2009, the first floating wind Spar platform was installed in the North Sea and there are now 19 floating wind Spar platforms in the world. The number floating wind Spars is expected to grow much larger as the world is moving from fossil energy to renewable energy, and floating wind is predicted to become a much larger industry than floating oil for the next 30 years. In this talk, Dr. WANG will share his experience and stories about living and witnessing the development and progression of the Spar platform technology as well as his vision of the future.

Biography:

Dr. WANG Jin is currently a professor at Shanghai Jiao Tong University. He obtained his master's and PHD degrees from Texas A&M University and bachelor's degree from Shanghai Jiao Tong University in naval architecture and ocean engineering. Dr. WANG has over 30 years of experience in the offshore industry specializing in the design of deepwater floating structures, mainly Spar platforms. He is co-founder and vice president of COTEC Offshore Engineering Solutions. He worked as lead engineer on many deepwater Spar projects at large international engineering companies. Dr. Wang is a registered professional engineer in the USA and a Fellow of the American Society of Civil Engineers. He holds more than 30 patents and has over 80 publications.

About Hudong-Zhonghua Shipbuilding (Group) Co. Ltd.

Hudong-Zhonghua Shipbuilding (Group) Co., Ltd. is one of the major shipbuilding enterprises under the flag of China State Shipbuilding Corporation (CSSC). The Company consists of one headquarter in Pudong of Shanghai, and three shipyards, i.e. the main yard, Shanghai Shipyard Co. Ltd., and Shanghai jiangnan-Changxing Shipbuilding Co., Ltd., being a comprehensive industrial conglomerate specialized in building ships, offshore engineering products and non-ship products.

We have maintained our position as the most advanced manufacturer in building large marine LNG storage and transportation equipment in China. Since the delivery of the first LNGC in 2008, we have seen a fleet of over 40 large LNG carriers sailing to the vast ocean, and another 40 plus units waiting to be delivered in coming future.

Hudong-Zhonghua has also earned a global reputation in building container vessels. We have an outstanding track record of delivering more than 60 units of 8,000TEU and above super-large container ships. Besides, we have also scored great success in building 45,000DWT container ro/ro ships, 38,000DWT and 49,000DWT duplex stainless steel chemical tankers, and 3,000T fishery resource survey ships. All of these achievements are strong reflection of our commitment for constant improvement, innovation and outperformance.

In Hudong-Zhonghua, we lead market demand through innovation, support strategic development by high-end manufacturing, and serve national rejuvenation with creativity, and are committed to emerging as a world-class manufacturer of hi-tech marine equipment.

Tourist Attractions

Shanghai is one of the most modern cities in China and also has many historical and cultural sites. We have recommended many famous tourist attractions for you. The routes to these tourist attractions can be found through some apps like Baidu Map, Gaode Map, and Google Map.

Oriental Pearl TV Tower

Waitan

Yu Garden

Shanghai Disneyland Park

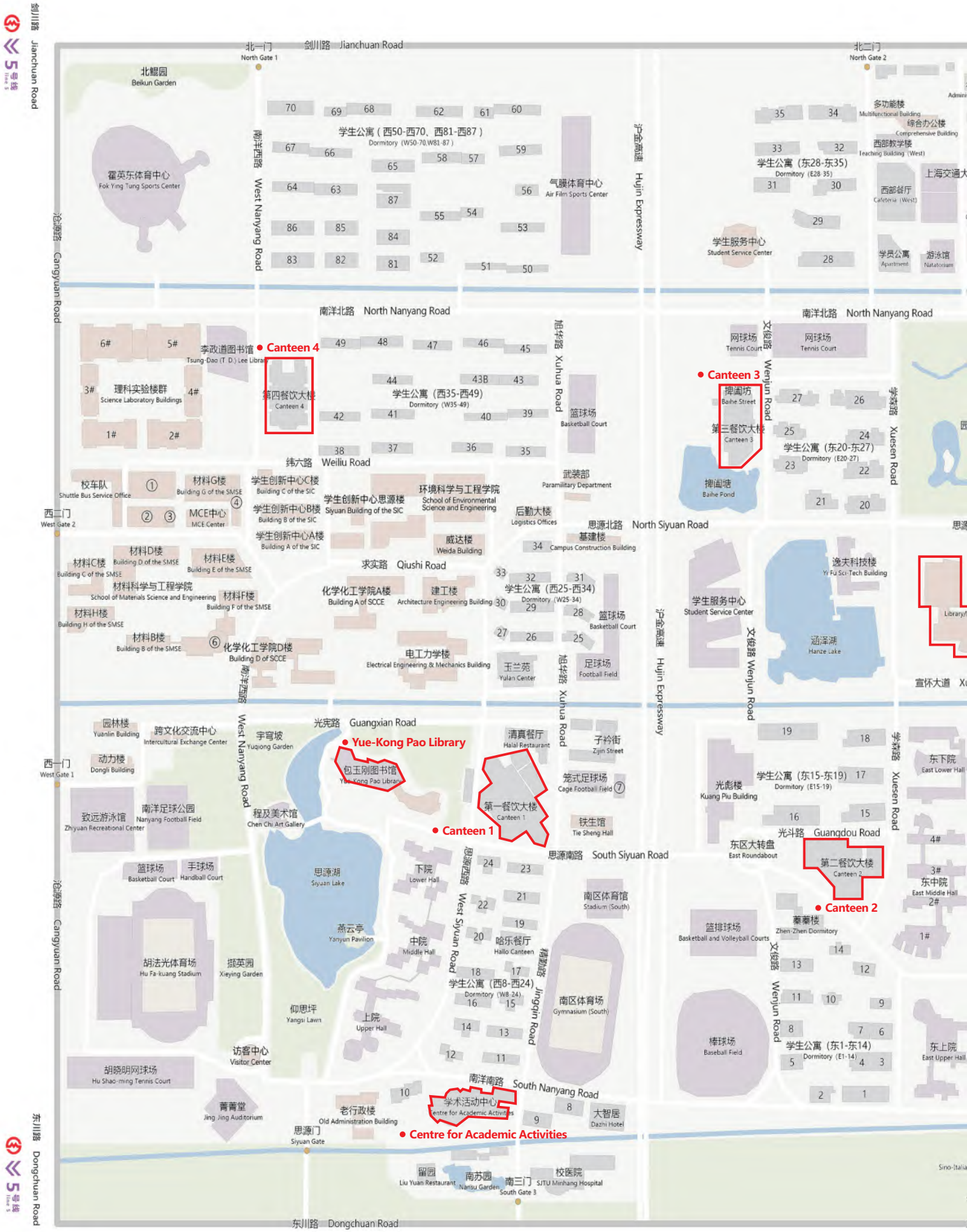
Shanghai Haichang Ocean Park

Shanghai Planetarium

Shanghai Museum

Shanghai World Expo Exhibition and Convention Center

SJTU Minhang Campus Map




剑川路 Jianchuan Road
北三门 North Gate 3
剑川路 Jianchuan Road
实验楼 Laboratory Building
体育馆 Stadium
仿真中心 Simulation Centre
东部教学楼 Teaching Building (East)
图书馆 Library
学国家电投智慧能源创新学院 College of Smart Energy
东部餐厅 Cafeteria (East)
学生宿舍楼 Dormitory Building
招待所 Hotel
实习工场 Practice Workshop
学员公寓 Apartment
农业与生物学院 School of Agriculture and Biology
实验动物中心 Laboratory Animal Center
农场 Farm
农业与生物学院 School of Agriculture and Biology
现代农业工程训练中心 Modern Agriculture Engineering Training Center
文治大道 Wenzhi Avenue
莲花南路 South Lianhua Road
南洋北路 North Nanyang Road
暖春园 Nuanchun Garden
系统生物学研究院 Shanghai Center for Systems Biomedicine
文选医学大楼 Wenxuan Building of Medicine
动物中心 Animal Center
拖曳水池 Towing Tank
School of Naval Architecture, Ocean & Civil Engineering
船舶海洋与建筑工程学院 School of Naval Architecture, Ocean & Civil Engineering
第七餐饮大楼 Canteen 7
4#
7#
药学院 School of Pharmacy
3#
6#
生命科学技术学院 School of Life Science and Biotechnology
2#
5#
1#
南洋东路 East Nanyang Road
Zhaohuan Road 照葭路
能源研究院 Research Institute of Energy
海洋深水试验池 Deep-sea Test Tank
树林植物标本园 Botanical Garden
叔同路 Shutong Road
龙坡路 Longpo Road
转化医学研究院 National Infrastructures for Translational Medicine
北路 North Siyuan Road
思源北路 North Siyuan Road
蔷薇园 Rose Garden
第六餐饮大楼 Canteen 6
行政A楼 Administration Building A
综合实验楼 Comprehensive Laboratory Building
图信大楼 Network and Information Center
行政B楼 Administration Building B
Library/Network and Information Center
校友林 Alumni Woods
东大门 East Main Gate
uanhuai Avenue
宣怀大道 Xuanhuai Avenue
宣怀大道 Xuanhuai Avenue
龙坡路 Longpo Road
思源东路 East Siyuan Road
1#
2#
3#
陈瑞球楼 Chan Sui Kau Hall
致远湖 Zhiyuan Lake
致远湖 Zhiyuan Lake
汽车楼（D楼） Automobile Building (Building D)
文博楼 Wenbo Building
能源动力楼（C楼） Energy and Power Engineering Building (Building C)
媒体与传播学院 School of Media and Communication
叔同路 Shutong Road
电子信息与电气工程学院 School of Electronic Information and Electrical Engineering
希雅路 Xiya Road
机械与动力工程学院 School of Mechanical Engineering
马克思主义学院、凯原法学院 School of Marxism KoGuan School of Law
龙坡路 Longpo Road
Canteen 5
4#
上海交大密西根学院 UM-SJTU Joint Institute
设计学院 School of Design
Yuanpei Road
第五餐饮大楼 Canteen 5
5#
办公楼（A楼） Office Building (Building A)
东三门 East Gate 3
先进制造楼（B楼） Advanced Manufacture Building (Building B)
南洋东路 East Nanyang Road
文治大道 Wenzhi Avenue
思源南路 South Siyuan Road
智能电网中心楼 Smart Grid Center
莲花南路 South Lianhua Road
紫竹高新区 Zizhu Hi-tech Park
人文学院 School of Humanities
软件学院 School of Software
微电子学院 School of Microelectronics
航空航天学院 School of Aeronautics and Astronautics
外国语学院 School of Foreign Languages
南洋南路 South Nanyang Road
南洋南路 South Nanyang Road
中意绿色能源楼 Green Energy Laboratory
东晖园 Donghui Building
智能大楼 Smart Building
南大门 South Main Gate
海洋科学大楼 Building of Oceangraphy
南二门 South Gate 2
东川路 Dongchuan Road
东川路 Dongchuan Road

Traffic

• From airport and railway station

Shanghai Pudong International Airport	bus	Airport Line 7	Shanghai south railway station	metro Line 15 → Shanghai Jiao Tong University
Shanghai Pudong International Airport	metro	Line 2	Loushanguan Road	metro Line 15 → Shanghai Jiao Tong University
Shanghai Hongqiao International Airport	metro	Line 2	Loushanguan Road	metro Line 15 → Shanghai Jiao Tong University
Shanghai Hongqiao Railway Station	metro	Line 2	Loushanguan Road	metro Line 15 → Shanghai Jiao Tong University
Shanghai Railway Station	metro	Line 1	Shanghai south railway station	metro Line 15 → Shanghai Jiao Tong University

• Map around SJTU