LI SHEN

Postdoctoral Research Assistant
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EDUCATION

DPhil in Engineering Science October 2018 – January 2022
Department of Engineering Science & Jesus College, University of Oxford
Supervisors: Prof. Richard Stone FREng & Prof. Ben Williams; Project sponsors: Jaguar Land Rover & Innovate UK
Thesis title: Validation of Flow Simulation Model using Particle Image Velocimetry Data and Dimensionality Reduction Techniques

Master of Science in Mechanical Engineering September 2015 – March 2018
University of Michigan – Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University
Advisor: Prof. David L.S. Hung and Prof. Kwee-Yan Teh; Project sponsor: General Motors
Thesis title: Applications of Proper Orthogonal Decomposition for In-Cylinder Flow Field Evolution Analysis

Bachelor of Science in Mechanical Engineering September 2011 – August 2015
University of Michigan – Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University
Final-year project advisor: Prof. Kwee-Yan Teh; Project sponsor: General Electric
Thesis title: Thermal Power Plant Boiler Modeling and Simulation

TEACHING EXPERIENCE

B Paper Lead Tutor Academic Year 2022–2023
Department of Engineering Science, University of Oxford

- Tutoring 30 Oxford undergraduate students (in group of 3 – 4) in **B7** Applied Thermodynamics, Multiphase Flow and Heat Transfer, Separation Processes
- As the B7 Lead Tutor, organising the tutorials and review classes for over 40 third-year students and among three tutors
- Responsible for setting and marking collections for the B7 paper in this academic year

College Tutor and B Paper Tutor Academic Years 2019 – 2021
St. Hughs College & Wycliffe Hall & Department of Engineering Science, University of Oxford

- Tutored 10 Oxford undergraduate students (in group of 2 – 3) in **P4** Dimensional Analysis, **P4** Heat and Mass Transfer (originally in **A4**) as a college tutor
- Tutored 13 Oxford undergraduate students (in group of 3 – 4) in **B7** as a B paper tutor in the Department
- Provided one-to-one tutoring service for oversea visiting students in **P4** Thermodynamics
- Hosted tutorials, guided the students to have self-motivated academic discussions, helped them understand core course materials and provided instructions upon their queries
- Lectured in review classes, marked collections and wrote TMS reports regarding students' performance

Lead Lab Demonstrator Academic Years 2018 – 2023
Department of Engineering Science, University of Oxford

- Demonstrated and offered guidance in **P5** Thermodynamics lab to over 130 Oxford undergraduate students majored in Engineering Science
- Instructed the students to quantify engine efficiency using Thermodynamics principles
- Helped to prepare lab materials, including handouts, pre-recorded induction videos and lab setups
- Served as the team leader of the lab demonstrators, organised demonstrating schedules and coordinated course materials and score release on course management systems such as Canvas

Teaching Assistant Academic Years 2013 – 2018
University of Michigan – Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University

- Tutored four core undergraduate engineering courses for a total of 13 times, including Introductory Thermodynamics (equivalent to **P4**), Intermediate Thermodynamics (equivalent to **A4**), Introductory Automotive Engineering and Chemistry Lab
- Helped over 500 students from eight different countries better understand course materials and gain knowledge in corresponding subjects
- Hold full-English-based weekly recitation lectures (in classes of 30 students each time) for over four years
- Cooperated with other teaching assistants and served as lead TA for a group of 10

SERVICES FOR STUDENT ACTIVITIES

Admissions Assistant in Engineering Science December 2021
Jesus College, University of Oxford

- Coordinated with College Admission Officers and Chief Examiners to interview undergraduate candidates
- Performed technical support to the candidates during the online interview process

Student Advisor and Pastoral Mentor Academic Years 2015 – 2018
University of Michigan – Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University

- Helped more than 60 first- and second-year students to adapt to college life and studies in the university
- Organised over 10 talks on various topics including time management, career plan, emotion control and leadership development, and invited experts to share their experiences with young college students
- Provided pastoral support to the students who were under stress or encountering academic difficulties

Chief Teaching Assistant Mentor Academic Years 2015 – 2018
Center for Learning and Teaching,
University of Michigan – Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University

- Managed a team of twelve teaching assistant mentors and trained over 300 new teaching assistants
- Organised seven teaching assistant orientation conferences (about 50 attendees each time) and 26 workshops to tutor new TAs in communicating with students, evaluating students' performance and using course management systems
- Served as executive editor and led a team of four to write the teaching assistant handbook of the University of Michigan – Shanghai Jiao Tong University Joint Institute (≈ 60 pages, all written in English)

RESEARCH EXPERIENCE

Ammonia Sprays Measurement and Modelling
(Principal Investigator: Prof. Felix Leach; Project sponsor: EPSRC) January 2022 – Current
Serving as the only postdoctoral research assistant on the project and the project manager for the experimental work

- Build a lab from scratch for ammonia spray measurement and liaise with multiple authorities in the meantime
- Design an optically accessible spray chamber for ammonia injection at high ambient pressures and construct a high-pressure delivery and injection system for ammonia
- Provide fundamental ammonia spray data sets using experimental tools such as backlit spray imaging and droplet size distribution measurements, and perform spray image analysis to understand the multi-phase behaviour of ammonia
- Collaborate with an in-house simulation team to develop new spray simulation models for ammonia
- Develop numerical methods to validate ammonia spray simulation models using experimental data at various working conditions and with different physical quantities
- Work with collaborators from other universities and industrial partners to investigate the possibility of using ammonia as an alternative fuel and hydrogen carrier to help reducing green house gas emissions and achieving a carbon-neutral society sooner

Validation of In-Cylinder Flow Simulation Model Using Particle Image Velocimetry (PIV) Measurements
(Supervisors: Prof. Richard Stone FREng & Prof. Ben Williams) October 2018 – January 2022
DPhil thesis work

- Designed a laser diagnostic system and conducted tests using the high-speed PIV technique to measure in-cylinder flow fields in a near-production optically accessible engine on multiple planes and under different loads
- Worked with colleagues within the research group to maintain daily operations of the optical engine for data collection
- Cooperated with engineers from industrial partners to validate commercial flow simulation models
- Developed algorithms based on data dimensionality reduction techniques such as proper orthogonal decomposition (POD) and kernel principal component analysis (KPCA) to extract coherent flow structure for flow model validation
- Attended domestic and international conferences and presented research findings to larger audiences
- Presented research updates to industrial partners on a weekly basis, and prompted their new hybrid engine designs for a better eco-friendly compatibility and with lower emissions

Quantification of Cyclic Variation for In-Cylinder Temperature Fields
(Advisor: Prof. David L.S. Hung) April 2018 – September 2018
Served as a research assistant in the University of Michigan – Shanghai Jiao Tong University Joint Institute

- Coordinated the collaboration between two research groups respectively at Shanghai Jiao Tong University and the University of Oxford
- Examined correlation between in-cylinder temperature fields and engine operation parameters, and quantified the cyclic temperature variation using the proper orthogonal decomposition (POD) technique
- Identified flawed in-cylinder temperature measurements from a large data set using a novel outlier detection algorithm
- A publication associated to this work received the 2019 SAE Myers Award for Outstanding Student Paper

In-Cylinder Flow Fields Analysis by Means of Proper Orthogonal Decomposition
(Advisors: Prof. Kwee-Yan Teh & Prof. David L.S. Hung) April 2016 – March 2018
M.Sc. thesis work

- Introduced a novel outlier definition in particle image velocimetry (PIV) data sets
- Developed an algorithm to refine datasets and improved reliability of proper orthogonal decomposition (POD) results
- Expanded the application of relevance index and explained the evolution of high-kinetic-energy POD modes

SELECTED PUBLICATIONS

- **Shen, L.**, Willman, C. and Stone, R., "Investigation of Flow and Flame Propagation in a Spark Ignition Direct Injection Engine Using Particle Image Velocimetry," *Proceedings of the ASME 2022 ICE Forward Conference*, ICEF2022-90622, 2022. doi: 10.1115/ICEF2022-90622
- **Shen, L.**, Willman, C., Stone, R., et al., "On the use of particle image velocimetry (PIV) data for the validation of Reynolds averaged Navier-Stokes (RANS) simulations during the intake process of a spark ignition direct injection (SIDI) engine," *Int. J. Engine Res.* 23(6): 1061–1081, 2022. doi: 10.1177/14680874211001257
- **Shen, L.**, Willman, C., Stone, R., et al., "Multi-Plane PIV Measurements in a Gasoline Direct Injection Engine," *SAE Int. J. Adv. & Curr. Prac. in Mobility* 3(1): 233–239, 2020. doi: 10.4271/2020-01-2049
- **Shen, L.**, Teh, K., Ge, P., et al., "In-Cylinder Flow Fields Evolution Analysis and Low-Dimensional Model by Means of Proper Orthogonal Decomposition," *Int. J. Engine Res.* 22(5): 1714–1730, 2021. doi: 10.1177/1468087420917246
- Willman, C., **Shen, L.**, Camm, J., et al., "Cycle-to-Cycle Variation Analysis of Two-Colour PLIF Temperature Measurements Calibrated with Laser Induced Grating Spectroscopy in a Firing GDI Engine," *SAE Int. J. Adv. & Curr. Prac. in Mobility* 1(4): 1404–1419, 2019. doi: 10.4271/2019-01-0722

SELECTED AWARDS

UM-SJTU JI Outstanding Teaching Assistant	*May 2015 & May 2017*
UM-SJTU JI Outstanding Teaching Assistant Mentor	*May 2017*
Shanghai Jiao Tong University Distinguished Student Advisor	*January 2017*
2019 SAE Myers Award for Outstanding Student Paper	*January 2020*