Xinzhi Xue

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EDUCATION

Johns Hopkins University

Ph.D. Candidate, Mechanical Engineering — Anticipated July. 2020

Dissertation: *Experimental study of multiphase turbulent buoyant jet and its fragmentation*

Advisor: Prof. Joseph Katz

Minor in Violin, Peabody Conservatory

Johns Hopkins University

M.S., Mechanical Engineering — Dec. 2015

Harbin Institute of Technology

B.E., Mechanical Engineering Honors School — July. 2013

RESEARCH INTERESTS

– Multiphase flow, jet spray instability, fragmentation, turbulent mixing, and aerosol generation
– Laser diagnostic techniques for turbulence flow and particle/droplet/bubble measurements
– Machine learning based image segmentation, morphology analysis, holography and ultrasonic imaging
– Application of quantitive measurement techniques to combustion, biofluids and musical instruments

PROFESSIONAL EXPERIENCE

1) Research Experience

Graduate Research Assistant — Aug. 2013-Present

Mechanical Engineering, Johns Hopkins University

Project: Refractive index-matched vertical oil jet fragmentation in the water (funded by GOMRI-DROPPS).

– Developed experimental techniques and constructed the apparatus to study oil jet fragmentation with simultaneous Particle Image Velocimetry (PIV) and Planar Laser-Induced Fluorescence (PLIF).
– Measured the interface distribution and turbulence statistics simultaneously at high resolution in optically opaque multiphase flow using refractive index-matched surrogate fluid pairs.
– Implemented image processing algorithm for droplet morphology analysis, including Wavelet-Fourier based image enhancement, random forest-based segmentation for the PLIF images.
– Elucidated the physical mechanisms of the compound droplets formation and proposed a Cavitation number range and scaling for the generation of compound droplets in the nearfield of a buoyant jet.

Project: Effects of dispersant of an buoyant oil jet in crossflow (funded by GOMRI-DROPPS).

– Designed and constructed a miniaturized submersible holographic camera to measure droplet size distribution of an oil jet in crossflow.
– Implemented the reconstruction of the hologram, identification of droplets' locations, sizes with Hough transform and parameter space selections.
– Elucidated the effects of dispersant/surfactant on the jet trajectory in crossflow by correlating the strength of the counter-rotating vortex pair with the droplet size distribution using a trapping function.

Supporting in Projects:

– Assisted the microscopic visualization of human bronchial epithelial cells and the image correlation data analysis for cell motion.

– Conducted flow field measurements in the low-speed wind wave tank with an anemometer, achieved uniform mean flow condition by the installation of density gradient mesh screens in the wind-tunnel.
– Implemented contrast agents underwater ultrasonic imaging for flow measurements.

Undergraduate Research Assistant Jun. 2013
Mechanical Engineering, Harbin Institute of Technology

– Designed microfluidic pump, unidirectional valve in PDMS microfluidic channel, and automatic camouflage liquid film device. (Patent issued)
– Assisted the identification of the cause of failure in the electrohydraulic servo valve by high-speed visualization and numerical simulations of the cavitation onset.

Team Leader of National Technology Innovation Project (Silver Medal) May. 2012
Harbin Institute of Technology

– Provided low-cost solution to plantar pressure distribution measurement by conceptualizing and constructing an internal-reflection-based instrument and associated GUI.

2) Teaching Experience

Teaching assistant, Thermodynamics, Johns Hopkins University Fall 2017
Instructor: Prof. Joseph Katz

Teaching assistant, Fluid Dynamics Lab, Johns Hopkins University Fall 2016
Instructor: Prof. Steve Marra

Teaching assistant, Jet and Rocket Propulsion, Johns Hopkins University Spring 2016
Instructor: Prof. Joseph Katz

Mentor of laboratory research for three undergraduates 2016-2018

Tutor of violin for two pre-college students 2019

HONORS and AWARDS

Scholar, Gulf of Mexico Research Initiative	2016
Departmental Fellowship of the Johns Hopkins University	2013
Sohmen Scholarship of Purdue University (exchange student)	2012
Silver Medal of China National Technological Innovation Project	2012
Li Fung Scholarship of University of Hong Kong (exchange student)	2011
Orbita Scholarship of Harbin Institute of Technology	2010

SKILLS

– Quantitive Measurement: PIV, PLIF, High-speed camera, Holographic microscopy, Ultrasound imaging.
– Laboratory Facilities: Towing tank, Water/Wind tunnel, Wave tank, Submersible instrument, Microfluidics.
– Programming and Data Processing: Matlab, Python, C, Labview, ImageJ, Tecplot, Davis.
– Mechanical Design and CFD Simulation: SolidWorks, CATIA, AutoCAD, ANSYS Fluent, COMSOL.

SELECTED GRADUATE LEVEL COURSES

Fluid Dynamics (Incompressible flow), Prof. Andrea Prosperetti
Fluid Dynamics II (Compressible flow & Aerodynamics), Prof. Joseph Katz
Convection, Prof. Charles Meneveau
Hydrodynamic Stability, Prof. Tamer Zaki
Multiphase Flow (a.u.), Prof. Andrea Prosperetti & Prof. Gretar Tryggvason
Turbulence, Prof. Charles Meneveau
Introduction to Water Wave Mechanics, Prof. Robert A. Dalrymple

Advanced Math Methods for Engineers, Prof. Andrea Prosperetti
Optical Measurement Techniques, Prof. Joseph Katz
Numerical Methods, Prof. Rajat Mittal
Light & Optics, Prof. Brice Menard
Image Processing & Analysis, Prof. John Goutsias

AFFILIATIONS and SERVICES

Member, American Geophysical Union	2020
Volunteer, The 10th International Symposium on Cavitation	2018
Member, American Physical Society	2015

PATENTS

CN103105794A Liquid automatic discoloring disguised film device
CN103048805A Manual liquid color-change glasses
CN103197437A Photosensitive fluid photo-grey glasses
CN102998813A Automatic photochromic glasses with liquids
CN103235420A Micro-channel fluid photo-grey glasses

PUBLICATIONS

Peer-Reviewed Journal Articles

Xue, X., Katz, J. (2019) Formation of compound droplets during fragmentation of turbulent buoyant oil jet in water. *Journal of Fluid Mechanics*, 878, 98-112.

Murphy, D., **Xue, X.**, Sampath, K., Katz, J. (2016) Crude oil jets in crossflow: effects of dispersant concentration on plume behavior. *Journal of Geophysical Research: Oceans*, 121 (6), 4264-4281.

Li, S., Aung, N. Z., Zhang, S., Cao, J., **Xue, X.** (2013). Experimental and numerical investigation of the cavitation phenomenon in flapper–nozzle pilot stage of an electrohydraulic servo-valve. *Computers & Fluids*, 88, 590-598.

Daskiran, C., **Xue, X.**, Cui, F., Katz, J., Boufadel, M.C. (2020) Large eddy simulation and experiment of shear breakup in liquid-liquid jet: formation of ligaments and droplets. *In preparation for the International Journal of Multiphase Flow*.

Xue, X., Chandrala, L., Katz, J. (2020) Phase-conditioned turbulent statistics of an immiscible buoyant jet in the nearfield. *In preparation.*

Peer-Reviewed Conference Proceedings

Xue, X., Katz, J. (2017) Refractive index matched visualization and particle image velocimetry measurements of the initial breakup of turbulent oil jet. *International Oil Spill Conference Proceedings 2017*, (1), 2017328

CONFERENCE PRESENTATIONS

Presenters are shown by underline

Xue, X., Katz, J. (2020). Measurements of flow structure and turbulence in the nearfield of an oil jet in water. *The Gulf of Mexico Oil Spill & Ecosystem Science Conference 2020*, February 3-7, Tampa, FL.

Xue, X., Katz, J. (2019). Formation of compound droplets by turbulent buoyant oil jet and plume. *The 42nd AMOP Technical Seminar on Environmental Contamination and Response*, June 4-6, Halifax, Canada.

Xue, X., Katz, J. (2019). Fragmentation of a turbulent buoyant oil jet in water. *The 9th International Conference on Multiphase Flow*, May 19-24, Rio de Janeiro, Brazil.

Xue, X., Katz, J. (2019). Simultaneous PLIF and PIV measurements on refractive index-matched immiscible buoyant oil jet fragmentation in water. *The Gulf of Mexico Oil Spill & Ecosystem Science Conference 2019*, February 4-7, New Orleans, LA.

Xue, X., Katz, J. (2018). Experimental statistics of compound droplets generated by immiscible buoyant oil jet fragmentation in water. *The 71st Annual Meeting of the APS Division of Fluid Dynamics*, November 18-20, Atlanta, GA.

Li, C., Murphy, D., Sampath, K., **Xue, X.**, Chandrala, L., AfsharMohajer, N., Nishida, K., Ronzhes, Y., Koehler, K., Sidhaye, R., Katz, J. (2018). Dispersion and health impacts of crude oil spills by physical and chemical processes. *The ASLO 2018 Summer Meeting*, June 10-15, Victoria, Canada.

Xue, X., Katz, J. (2017). Simultaneous PLIF and PIV measurement of a near field turbulent immiscible buoyant oil jet fragmentation in water using liquid-liquid refractive index matching. *The 70th Annual Meeting of the APS Division of Fluid Dynamics*, November 19-21, Denver, CO.

Xue, X., Katz, J. (2017). Index-matched simultaneous laser induced-fluorescence and particle image velocimetry measurement of oil jet fragmentation. *The 12th International Symposium on Particle Image Velocimetry*, June 19-21, Busan, Korea.

Xue, X., Katz, J. (2017). Refractive index-matched turbulent immiscible buoyant oil jet breakup in water. *The Gulf of Mexico Oil Spill & Ecosystem Science Conference 2017*, February 6-9, New Orleans, LA.

Xue, X., Katz, J. (2016). Experimental study on immiscible jet breakup using refractive index matched oil-water pair. *The 69th Annual Meeting of the APS Division of Fluid Dynamics*, November 20-22, Portland, OR.

Murphy, D., **Xue, X.**, Katz, J. (2016). Turbulent crude oil plumes in crossflow: Effect of counter-rotating vortex pair structures on oil residence in plume. *The 9th International Conference on Multiphase Flow*, May 22-27, Firenze, Italy.

Xue, X., Murphy, D., Sampath, K., Katz, J. (2016). Turbulent crude oil plume in crossflow: Effect of vortex structures on oil residence in plume. *The Gulf of Mexico Oil Spill & Ecosystem Science Conference 2016*, February 1-4, Tampa, FL.

Xue, X., Murphy, D., Katz, J. (2015). Turbulent crude oil jets in crossflow: Holographic measurements of droplet size distributions. *The 68th Annual Meeting of the APS Division of Fluid Dynamics*, November 22-24, Boston, MA.

Murphy, D., **Xue, X.**, & Katz, J. (2015). Turbulent crude oil jets in crossflow. *The Gulf of Mexico Oil Spill & Ecosystem Science Conference 2015*, February 16-19, Houston, TX.