Kaushik Sampath

Curriculum Vitae - June 2019

Contact Information

NRC Postdoctoral Fellow
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Education

Johns Hopkins University (JHU) — Baltimore, MD
Ph.D., Mechanical Engineering — 2017
M.S.E., Mechanical Engineering — 2013

National Institute of Technology (NIT) — Tiruchirappalli, India
B.Tech., Mechanical Engineering — 2011

Focus Areas

Fluid mechanics, oil spills, aerosols, cardiovascular flows, meta-materials.

Research Interests

Applied Experimental Fluid Mechanics

- **Defense:** Skin friction and flow noise over complex surfaces.
- **Biomedical:** Blood flow in cardiovascular systems and biomedical devices.
- **Industry:** Flows characterization in turbo-machines.

Optical and Acoustic sensing techniques

- Development of novel flow and pressure sensors.
- Imaging and velocimetry using multiple imaging modalities.

Multi-phase flows and Aerosol science

- Crude oil and dispersant spills in marine environments.
- Bubble dynamics, bursting, diffusion and interactions with media.
- Micro- and nano-aerosol production and flux characterization.

Skills and Proficiency

Laboratory Skills

- Optical system design with lasers, LEDs, cameras, optical elements, etc.
- Flow field measurement using optical and echo PIV/PTV.
- Refractive index matching, using acrylic and PDMS.
- Design, fabrication and assembly of test facilities for gases and liquids.
- Data acquisition with pressure, flow, oxygen, temperature sensors, etc.
- NI-compactRIO FPGA based high-speed data acquisition.
- 3D printing using PolyJet, SLA and FDM techniques.
- Computer Aided Manufacturing using CNC Machines.

Software Skills

- Programming and data acquisition using Matlab and LabView.
- CAD modeling using AutoCAD and Solidworks.
- Flow, acoustic and solid mechanics simulations using Comsol.
- Advanced image processing using Matlab, ImageJ, Photoshop, C++.

Research Experience

NRC Postdoctoral Fellow 2018-Present
Acoustics Division, Code 7165, U.S. Naval Research Laboratory (NRL) Washington, DC

- **Flow noise reduction using structured surfaces (2018-present)**
  Ongoing work using additive manufacturing methods to create bio-inspired surfaces that passively reduce turbulent flow noise. In collaboration with Dr. Charles Rohde, Dr. James Wissman and Alec Ikei. Project funded by the Office of Naval Research (ONR).
- **Development and testing of fully compliant flow sensors (2018-present)**
  Ongoing work in collaboration with Dr. James Wissman concerning the design, fabrication and performance characterization of fully stretchable sensors for measuring velocity and pressure in turbulent flows. Project funded by ONR.

Graduate Research Assistant (Advisor: Prof. Joseph Katz) 2011-2017
Department of Mechanical Engineering, Johns Hopkins University Baltimore, MD

- **Aerosolization of oil-dispersant mixtures due to bubble bursting (2016-17)**
  Assembled and tested vertical plume facility (13'x2'). Designed mechanical shear based bubble generator capable of producing bubble diameters from 80-600 μm. In collaboration with Dr. Nima Mohajer and Prof. Kirsten Koehler (Johns Hopkins Bloomberg School of Public Health), studied the micro- and nano- aerosol generation due to bubbles bursting on slicks of crude oil and dispersant.
- **Flow in LV thrombus patients using optimized echo PIV-PTV (2015-16)**
  Work performed in collaboration with Dr. Thura Harfi (now at Ohio State University) and Dr. Richard George (Johns Hopkins Medicine). Acquired contrast ultrasound images from patients with left ventricular thrombus. Developed an integrated processing approach combining image enhancement, PIV, PTV and optimization to obtain 2D time resolved velocity distributions inside the left ventricle.
- **Functional space and time resolved detection of platelets and VWF (2015-16)**
  As part of the Hopkins Heart Initiative, assisted Dr. Jacopo Biasetti (now at CorWave SA, France) in designing optical setups for fluorescence imaging of platelet activation and von Willebrand factor (VWF) cleavage in deep suspensions using a high-sensitivity EM-CCD camera. Developed image processing routines to enhance, detect and track activated platelets and VWF conformations.
- **Effects of dispersants on a crude oil jet in cross-flow (2015)**
  Assisted Dr. David Murphy (now at University of South Florida (USF)) with measurements in the 500 gal. JHU towing tank. Performed large field of view 2D PIV measurements to study the structure of a crude oil jet in cross flow with different dispersant-oil concentrations.
- **Interaction of oil droplets with density stratification and plankton (2014)**
  Assisted in experiments performed at the University of Texas - Marine Science Institute in collaboration with Texas Tech University. Performed high resolution 2D PIV measurements in the mesocosm (13'x2') test facility capturing interaction of oil droplets at the density interface with and without presence of plankton cultures.
- **Refractive-index matched PIV measurements in an automotive fan (2011-14)**
  Designed and assembled a 360 gal. refractive index matched flow facility for fan measurements. Performed high resolution phase locked 2D PIV measurements focusing at the inlet, near wake and tip gap of the fan.

Undergraduate Research Assistant (Advisor: Prof. Thomas Leweke) 2010
Institut de Recherche sur les Phénomènes Hors Equilibre Marseille, France

- **Flow characterization using PIV**
  Performed refurbishment and testing of PIV processing code: DPIVSoft. Assisted in 2D/3D PIV measurements to study helicopter-rotor wakes and boundary layer separation.

Undergraduate Research Assistant (Advisor: Prof. R.N. Govardhan) 2008-09
Department of Mechanical Engineering, Indian Institute of Science Bangalore, India

- **Application of PIV in micron-scale flows**
  Augmented in-house cross-correlation based digital PIV code with image enhancement, vector calculation and post-processing capabilities suited for micron scale applications.

Teaching Experience

Teaching Assistant, Mechanical Engineering, JHU Spring 2014, 2015
Heat Transfer Lab, (Instructor: Prof. Steven Marra)

Teaching Assistant, Mechanical Engineering, JHU Fall 2013, 2014
Introduction to Fluid Mechanics Lab, (Instructor: Prof. Steven Marra)

Teaching Assistant, Mechanical Engineering, JHU Spring 2012, 2014
Jet and Rocket Propulsion, (Instructor: Prof. Joseph Katz)

Undergraduate Mentorship

Joshua Gilbert & David Austin, Mechanical Engineering, JHU 2017
Aerosolization of oil-dispersant mixtures due to bubble bursting.

Brandon Fielder, Mechanical Engineering, JHU 2016
Testing of bubble generator to obtain specified bubble size distributions.

Alaleh Azhir, Biomedical Engineering, JHU 2015-16
Image processing routines for detection and tracking of platelets and VWF.

Benjamin Keyser & Alexander Naticchia, Mechanical Eng., JHU 2013-14
Assembly and testing of vertical plume facility for crude oil experiments.

Sri Krishna Uppaluri, Mechanical Engineering, JHU 2011-14
Refractive index matched PIV measurements in an automotive cooling fan.

Industrial Experience

Summer Undergraduate Trainee, Makino India, 2008
Performed study on CNC Machine Utilization and shop-floor innovations (kaizens).

In Plant Trainee, TVS Motor Company 2008
Trained at the assembly plant of TVS-50 Moped and TVS-Victor Motorcycle.

Grants

Anesthesiology & Critical Care Medicine StAAR Grant, JHU : $21,556 2019-20
Continuous ultrasound imaging platform for monitoring and surveillance - A. Pustavoitau (P.I.), M. A. L. Bell (co-P.I.), A. Manbachi (co-P.I.), **K. Sampath (co-P.I.)**. http://anesthesiology.hopkinsmedicine.org/?s=staar

CER Technology Fellowship Grant, JHU : $5,000 2014-15
Development of computational simulations to support undergraduate mechanical engineering thermal-fluids labs - S. P. Marra (Faculty), **K. Sampath (Fellow)**, S. K. Kandala (Fellow). https://cer.jhu.edu/techfellows

Honors and Awards

Editors' choice paper, Journal of Biomechanical Engineering 2018
Selected among top 12 papers published in 2018. https://doi.org/10.1115/1.4043072

NRC Postdoctoral Research Associateship Award, NRL 2017
Awarded by the National Academy of Sciences as a result of a national competition.

Creel Family Teaching Assistant Award, JHU 2015
Award to recognize the best teaching assistant in Mechanical Engineering, JHU.

Karnataka Regional Math Olympiad (KRMO) 2005
Ranked 1st in the state and selected for training at the Indian Institute of Science.

National Talent Search Examination (NTSE) Scholarship 2004
Selected among the top 1000 tenth grade students in India.

Co Curricular Activities

University Captain, BAJA PSI Racing, NIT Trichy 2010-11
Designed, fabricated, tested and raced All Terrain Vehicles at BAJA SAE India.

1:10 Scale, remote controlled Nitro Monster Truck 2009-10
Designed, fabricated and raced at several inter-university championships.

Professional Memberships

Acoustical Society of America (ASA)	2019-present
American Physical Society (APS)	2011-present
American Society of Mechanical Engineers (ASME)	2011-present
American Institute of Aeronautics and Astronautics (AIAA)	2011-present
Hopkins Heart Initiative, JHU	2015-16
Dispersion Research on Oil Physics & Plankton Studies, GoMRI	2014-17

Peer Reviewer

Acta Mechanica	2019-present
Journal of the American Society of Echocardiography (JASE)	2018-present
Cardiovascular Engineering and Technology (CVET)	2018-present
Journal of Mechanical Science and Technology (JMST)	2018-present

Hobbies

Percussionist - Tabla player 2010-present
Kallur Mahalakshmi Tabla Vidyalaya Bangalore, India

Puppeteer and Design Support 2010-present
Dhaatu Puppet Theater Bangalore, India

Journal publications

J. P. Wissman, **K. Sampath**, S. E. Freeman and C. A. Rohde, 2019. Capacitive Bio-Inspired Flow Sensing Cupula. Sensors, 19(11), 2639. https://doi.org/10.3390/s19112639

K. Sampath, N. Afshar-Mohajer, C. L. Dora, W. Heo, J. Gilbert, D. Austin, K. Koehler and J. Katz, 2019. Aerosolization of crude oil-dispersant slicks due to bubble bursting. Journal of Geophysical Research: Atmospheres, 124, 5555-5578. https://doi.org/10.1029/2018JD029338

K. Sampath, T. T. Harfi, R. T. George and J. Katz, 2018. Optimized Time-Resolved Echo Particle Image VelocimetryParticle Tracking Velocimetry Measurements Elucidate Blood Flow in Patients With Left Ventricular Thrombus. Journal of biomechanical engineering, 140(4), p.041010. https://doi.org/10.1115/1.4038886

J. Biasetti, **K. Sampath**, A. Cortez, A. Azhir, A. A. Gilad, T. S. Kickler, T. Obser, Z. M. Ruggeri and J. Katz, 2017. Space and Time Resolved Detection of Platelet Activation and von Willebrand Factor Conformational Changes in Deep Suspensions. International journal of biomedical imaging, 2017. https://doi.org/10.1155/2017/8318906

D. W. Murphy, X. Xue, **K. Sampath** and J. Katz, 2016. Crude oil jets in crossflow: Effects of dispersant concentration on plume behavior. Journal of Geophysical Research: Oceans, 121(6), pp.4264-4281. https://doi.org/10.1002/2015JC011574

Conference proceedings

J. Wissman, **K. Sampath**, A. Ikei, K.B. ztemiz, C. Majidi, C. A. Rohde, 2019. Soft-matter pressure sensors for turbulence detection. Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2019 Mar 27 (Vol. 10970, p. 109702D). International Society for Optics and Photonics. https://doi.org/10.1117/12.2514358

J. Wissman, **K. Sampath**, C. A. Rohde, 2019. Liquid metal-based bio-inspired capacitive flow sensor. InBioinspiration, Biomimetics, and Bioreplication IX 2019 Mar 13 (Vol. 10965, p. 109650T). International Society for Optics and Photonics. https://doi.org/10.1117/12.2514355

K. Sampath, S. K. Uppaluri, Y. S. Shin, M. Sortor and J. Katz, 2015. Phase Locked PIV Measurements in Wake of an Automotive Fan Model. Proc. Fan 2015 Conf.

Conference presentations (select)

K. Sampath, C. A. Rohde, J. Wissman and A. Ikei. Flow noise reduction using bio-inspired structured surfaces. Am. Phys. Soc., 2018.

K. Sampath, N. Afshar-Mohajer, C. L. Dora, W. Heo, J. Gilbert, D. Austin, K. Koehler and J. Katz. Aerosolization of crude oil-dispersant slicks due to popping of bubbles. Am. Phys. Soc., 2018.

J. Wissman, **K. Sampath** and C. A. Rohde. All-Soft Artificial Lateral Line Sensor Fabricated with Lost-Wax Processes and Liquid Metal. Society of Engineering Science (SES) (Madrid, Spain), 2018.

N. Afshar-Mohajer, **K. Sampath**, C. Li, A. M. Rule, J. Katz and K. Koehler. Health Risk Assessment of Exposure to Volatile Organic Compounds and Particulate Matter Emitted from Oily Seawater Treated with Dispersant. Gulf of Mexico Oil Spill & Ecosystem Science Conference 2018.

K. Sampath, N. Afshar-Mohajer, W. Heo, J. Gilbert, D. Austin, K. Koehler and J. Katz. Bubble Bursting Aerosolizes Slicks of Crude Oil-Dispersant Mixtures. Gulf of Mexico Oil Spill & Ecosystem Science Conference 2018.

N. Afshar-Mohajer, **K. Sampath**, A. M. Rule, J. Katz, K. Koehler. Aerosol Emission from Seawater Contaminated by Crude Oil and Crude Oil-Dispersant Slicks due to Bubble Bursting. 36th Annual American Association for Aerosol Research Conference. Raleigh, NC. 2017

K. Sampath, N. Afshar-Mohajer, W. Heo, J. Gilbert, D. Austin, K. Koehler, and J. Katz. Aerosolization of crude oil and dispersant slicks due to bubble bursting. Am. Phys. Soc., 2017.

K. Sampath, T. T. Harfi, R. T. George and J. Katz. Optimized PIV-PTV techniques for processing time-resolved in-vivo contrast ultrasound images. The 12th International Symposium on Particle Image Velocimetry 2017.

N. A. Mohajer, **K. Sampath**, A. M Rule, J. Katz, and K. Koehler. Aerosol Emissions from Crude Oil and Crude Oil-Dispersant Contaminated Seawaters due to Bubble Bursting. Gulf of Mexico Oil Spill & Ecosystem Science Conference 2017.

K. Sampath, T. T. Harfi, R. T. George and J. Katz. Flow in patients with left ventricular thrombus using optimized echo PIV-PTV. Bull. Am. Phys. Soc. Volume 61, 2016.