

Jessica K. Shang

Assistant Professor
Department of Mechanical Engineering
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Education

Stanford University Stanford, CA
Postdoctoral Fellow, School of Medicine July 2015 – June 2016
– Department of Pediatrics; Stanford Cardiovascular Institute. Advisor: Alison L. Marsden

Princeton University Princeton, NJ
PhD, Mechanical & Aerospace Engineering 2015
– Thesis: Flexibility and curvature effects on vortex dynamics and fluid-structure interactions.
Advisors: Profs. Howard A. Stone & Alexander J. Smits

University of Cambridge Cambridge, United Kingdom
MPhil, Engineering 2011
– Thesis: Effects of low-amplitude vibrations on impulsively-started wings at incidence. Supervisor:
Prof. Holger Babinsky

Harvard University Cambridge, MA
AB, Engineering Sciences, cum laude with highest honors 2008
– Thesis: Design and fabrication of a four-winged micro air vehicle. Advisor: Robert J. Wood.

Honors and Awards

NSF CAREER, 2021
Office of Naval Research Summer Faculty Research Fellow, 2017
Stanford Cardiovascular Institute Fellow, NIH T32 training grant, 2015
Larisse Rosentweig Klein Memorial Award (Princeton), 2013
Princeton University Francis Upton Graduate Fellow (Princeton), 2009
National Science Foundation Graduate Research Fellow, 2008
Gates Cambridge Scholar (Gates Foundation), 2008

Professional Service

Meeting organizer, technical chair (2021 – present): Thousand Islands Fluid Dynamics Meeting
Societies: American Physical Society, Society of Women Engineers (SWE), American Society of Mechanical Engineers
Study committee (Apr 2018 – Oct 2020): National Naval Responsibility & Engineering (National Academy of Sciences)
Grant proposal referee: National Sciences and Engineering Research Council of Canada (NSERC), Department of Energy (DOE), National Science Foundation (NSF)
Referee for *AIAA Journal*, *J. of Fluids and Structures*, *J. of Visualized Experiments*, *Ocean Engineering*, *Physics of Fluids*, *Physical Review Fluids*, *Physical Review E*, *Physical Review Fluids*, *Physical Review Letters*, *Biomechanics and Modeling in Mechanobiology*, *Cardiovascular Engineering and Technology*, *Royal Society Open Science*, *Naval Engineers Journal*
Session chair: SB3C 2016, *Aneurysm biomechanics*

University Service

Mechanical Engineering DEI Committee, Fall 2021 –

Faculty advisor, University of Rochester Society of Women Engineers (SWE) chapter, Fall 2016 – Fall 2021

Graduate Admissions Committee, Mechanical Engineering, Fall 2016 – 2020

Graduate Studies Committee, Mechanical Engineering, Fall 2016 –

Undergraduate Faculty Advisor for the Class of 2021, 2025, Mechanical Engineering

Mentoring

Postdoctoral associates

- Past (1): Jeong-Hyun Kim (2017-2018)

Graduate research advisees

- Current (5): Nitish Acharya (PhD), John (Brennen) Carr (PhD), Afreen Syeda (PhD), Kelin Kurzer-Ogul (PhD), Hao Yin (PhD)
- Past (2): William Gorman (MS 2018), Jessica Huhnke (MS 2018)

Graduate committees

- Thesis committees: Thomas Nevins *19, Samuel Mellon *19, Xin Bian *21, Linda Crandall *21

Undergraduate research advisees

- Current (3): Savannah Schisler, Charles Pan, Umar Mutwafy
- Past (11): Caroline Cardinale (2018-2021), Delin Zeng (2019-2020), Kai Kindred (2019-2020), Jack Billings (2018-2019), Deok-Hoon Jeong (2018-2019), Amro Bayoumy (2018-2019), Leo Liu (2018-2019), Khusbu Modi (2017), Diwas Gautam (2017), Bonyeob (Chris) Koo (2016-2017), Hunter Dell (2017)

Teaching

University of Rochester

Rochester, NY

- ME 241: Fluids Lab Spring 2017 – 2021
- ME 444: Continuum Mechanics Fall 2017
- ME 437: Incompressible Flow Fall 2018, 2020, 2021

Princeton University

Princeton, NJ

- MAE 433: Automatic control systems, Assistant-in-instruction. Spring 2013
- MAE 335: Fluid dynamics, Assistant-in-instruction. Fall 2012
- MAE 222: Mechanics of fluids, Assistant-in-instruction. Spring 2012

Harvard University

Cambridge, MA

- ES 123: Introduction to fluid mechanics and transport processes, Teaching fellow. Spring 2008
- ES 51: Computer-aided machine design, Teaching fellow. Fall 2006

Publications

Peer-Reviewed Articles

19. N. Acharya, H. Aluie, and J. K. Shang, 2022. Numerical investigation of laser-driven shock interaction with a deformable particle, *Physics of Plasmas*, **29(5)** 052302. <https://doi.org/10.1063/5.0083076>
18. A. Ladrón-de-Guevara, J. K. Shang, M. Nedergaard, and D. H. Kelley, 2022. Perivascular pumping in the mouse brain: Improved boundary conditions reconcile theory, simulation, and experiment, *Journal of Theoretical Biology*, **542** 111103.
17. X. Bian, J. K. Shang, E. G. Blackman, G. W. Collins, H. Aluie, 2021. Scaling of Turbulent Viscosity and Resistivity: Extracting a Scale-dependent Turbulent Magnetic Prandtl Number, *The Astrophysical Journal Letters*, **917 (1)** L3.
16. J. B. Carr, J. H. Thomas, J. Liu, and J. K. Shang, 2021. Peristaltic pumping in thin, non-axisymmetric, annular tubes, *Journal of Fluid Mechanics*, **917** doi:10.1017/jfm.2021.277.
15. M. Chiatto, J. K. Shang, L. de Luca, and F. Grasso, 2021. Insights into low Reynolds flow past finite curved cylinders, *Physics of Fluids*, **33(3)** 035150.
14. I. Scherl, B. Strom, J. K. Shang, O. Williams, B. L. Polagye, and S. L. Brunton, 2020. Robust principal component analysis for modal decomposition of corrupt fluid flows, *Physical Review Fluids*, **5 (5)** 054401.
13. A. C. Quillen, R. C. Nelson, H. Askari, K. Chotkowski, E. Wright, and J. K. Shang, 2019. A Light-weight Vibrational Motor Powered Recoil Robot that Hops Rapidly Across Granular Media, *Journal of Mechanisms and Robotics*, **11(6)** 061001.
12. J. H. Kim, R. Puranik, J. K. Shang, and D. M. Harris, 2019. Robust transferrable superhydrophobic surfaces, *Surface Engineering*, DOI: 10.1080/02670844.2019.1669109.
11. J. K. Shang, M. Esmaily, A. Verma, R. Figliola, O. Reinhartz, T. Y. Hsia, J. A. Feinstein, and A. L. Marsden, 2019. Patient-specific multiscale modeling of the assisted bidirectional Glenn, *Annals of Thoracic Surgery*, **107(4)** 1232-1239.
10. J. H. Kim, J. P. Rothstein, and J. K. Shang, 2018. Dynamics of a flexible superhydrophobic surface during a drop impact, *Phys. Fluids*, **30** 072102. (Selected as an AIP SciLight, <https://aip.scitation.org/doi/10.1063/1.5046659>.)
9. J. K. Shang, H. A. Stone, and A. J. Smits, 2018. Flow past a concave cylinder of constant curvature, *J. Fluid Mech.*, **837** 896-915.
8. A. Verma, M. Esmaily, J. K. Shang, R. Figliola, J. A. Feinstein, T. Y. Hsia, and A. L. Marsden, 2018. Optimization of the Assisted Bidirectional Glenn Procedure for First Stage Single Ventricle Repair, *World J. for Pediatric & Congenital Heart Surgery*, **9** 157-170.
7. I. Jacobi, J. S. Wexler, M. A. Samaha, J. K. Shang, B. J. Rosenberg, M. Hultmark, and H. A. Stone, 2015. Stratified thin-film flow in a rheometer, *Phys. Fluids*, **27** 052102.
6. J. K. Shang, H. A. Stone, and A. J. Smits, 2014. Vortex and structural dynamics of a flexible cylinder in cross-flow, *Phys. Fluids*, **26** 053605.
5. J. H. Tu, C. W. Rowley, J. N. Kutz, and J. K. Shang, 2014. Spectral analysis of fluid flows using sub-Nyquist-rate PIV data, *Exp. Fluids*, **55** 1805.
4. J. K. Shang, A. J. Smits, and H. A. Stone, 2013. The appearance of P+S modes in the wake of a freely vibrating, highly flexible cylinder, *J. Fluids Structures*, **43** 481-486.
3. J. K. Shang, B. M. Finio, S. A. Combes, and R. J. Wood, 2009. Artificial insect wings of arbitrary morphology for flapping wing MAVs, *J. Bioinspir. Biomim.*, **4** 036002.

2. B. O. Mysen and J. Shang, 2005. Evidence from olivine/melt element partitioning that nonbridging oxygen in silicate melts are not equivalent, *Geochim. Cosmochim. Acta*, **69** 2861-2875.
1. B. O. Mysen and J. Shang, 2003. Fractionation of major element between co-existing H_2O silicate melt and silicate-saturated aqueous fluid in aluminosilicate systems at 1-2 GPa, *Geochim. Cosmochim. Acta*, **67** 3925-3936.

Invited Articles

1. J. K. Shang, H. Aluie, J. R. Rygg, R. Betti, A. E. Gleason, D. N. Polsin, D. H. Kelley, G. W. Collins, 2019. Probing High-Energy Density Flows with X-Ray Particle Image Velocimetry, *NNSA Stewardship Science Quarterly*, limited circulation.

Refereed Abstracts/Proceedings

7. J. Tithof, J. B. Carr, J. Liu, H. Mestre, T. Du, M. Nedergaard, J. H. Thomas, J. Shang, and D. H. Kelley, 2021. Cerebrospinal fluid mechanics in the brain: modeling, *International Congress of Theoretical and Applied Mathematics (ICTAM)*, held virtually (COVID-19).
6. J. Shang, J. B. Carr, C. Cardinale, D. Zeng, 2021. Peristaltic Pumping in Sub-Wavelength Perivascular Models, *Summer Biomechanics, Bioengineering, and Biotransport Conference*, held virtually (COVID-19).
5. J. Carr, J. Shang, 2020. The Effect of Domain Length on Simulations of Peristaltic Pumping in the Perivascular Space, *Summer Biomechanics, Bioengineering, and Biotransport Conference*, held virtually (COVID-19).
4. J. Carr, J. Tithof, J. Thomas, D. Kelley, J. Shang, 2019. Perivascular Pumping In An Idealized Model Of The Glymphatic System, *Annual Meeting of the Biomedical Engineering Society*, Philadelphia, PA.
3. A. Verma, M. Esmaily, J. K. Shang, R. Figliola, T. Y. Hsia, and A. L. Marsden, 2017. Optimization of Systemic-to-Pulmonary Shunt Design in the Assisted Bi-directional Glenn, *Summer Biomechanics, Bioengineering, and Biotransport Conference*, Tuscon, AZ.
2. J. Shang, M. Esmaily-Moghadam, T. Khalapyan, R. Figliola, O. Reinhartz, T.-Y. Hsia, A. Marsden, 2016. Implementation of the Assisted Bidirectional Glenn in an Idealized Single Ventricle Model, *Summer Biomechanics, Bioengineering, and Biotransport Conference*, National Harbor, MD.
1. B. M. Finio, J. K. Shang, and R. J. Wood, May 2009. Body torque modulation of a microrobotic fly, *IEEE International Conference on Robotics and Automation*, Kobe, Japan.

Presentations

Invited Seminars

13. Sandia National Laboratory, HEDP Seminar Series (March 2022)
12. Cornell University, Fluid Mechanics Seminar Series (Sept 2021)
11. Penn State University, Dept of Mechanical Engineering (Sept 2021)
10. Syracuse University, Dept of Mechanical Engineering (Dec 2018)
9. George Washington University, Dept of Mechanical Engineering (Oct 2016)
8. Rochester Institute of Technology, Center for Applied and Computational Mathematics (Oct 2016)
7. University of Rochester, Physical Models of Biological Systems (Aug 2016)
6. University of Rochester, Dept of Mechanical Engineering (Feb 2015)
5. Georgia Tech, Woodruff School of Mechanical Engineering (Feb 2015)
4. UC Davis, Dept of Mechanical and Aerospace Engineering (Feb 2015)

3. UC Santa Barbara, Dept of Mechanical Engineering (May 2014)
2. University of Notre Dame, Dept of Aerospace and Mechanical Engineering (Apr 2014)
1. MIT, Women in Aerospace Symposium (Apr 2013)

Oral Presentations

20. J Carr, J Shang, 2021. A 1-D Pulse Wave Model Coupling Arterial and Perivascular Flow, *74th Annual Meeting, APS DFD*, Phoenix, AZ.
19. J Carr, C Cardinale, D Zeng, J Shang, 2020. Effect of Channel Length on Peristaltic Pumping, *73rd Annual Meeting, APS DFD*, online.
18. N Acharya, J Shang, H Aluie, 2020. Hydrodynamics of laser-driven shock interaction with a deformable particle, *62nd Annual Meeting, APS DPP*, online.
17. M. Chiatto, C. Cardinale, J. K. Shang, L. de Luca, F. Grasso, 2019. Spectral POD analysis of low Reynolds flow past finite cylinders, *72nd Annual Meeting, APS DFD*, Seattle, WA.
16. J. B. Carr, J. H. Thomas, J. K. Shang, 2019. Peristaltic Pumping in an Elliptical-Annulus Model of a Perivascular Space, *72nd Annual Meeting, APS DFD*, Seattle, WA.
15. J. H. Kim, W. Gorman, J. Shang, 2017. Droplet impact dynamics on flexible superhydrophobic surfaces, *70th Annual Meeting, APS DFD*, Boulder, CO.
14. A. Verma, J. Shang, M. Esmaily, K. Wong, A. Marsden, 2016. Shape Optimization of the Assisted Bi-directional Glenn surgery for stage-1 single ventricle palliation, *69th Annual Meeting, APS DFD*, Portland, OR.
13. J. Shang, M. Esmaily, R. Figliola, T.-Y. Hsia, A. Marsden, 2016. Patient-specific modeling of the Assisted Bidirectional Glenn (ABG), *69th Annual Meeting, APS DFD*, Portland, OR.
12. J. Shang, A. J. Smits, H. A. Stone, 2015. Flow past a finite cylinder of constant curvature, *68th Annual Meeting, APS DFD*, Boston, MA.
11. A. Marsden, J. Shang, M. Esmaily-Moghadam, R. Figliola, O. Reinhartz, T.-Y. Hsia, 2015. Optimization of the assisted bidirectional Glenn for single ventricle palliation, *68th Annual Meeting, APS DFD*, Boston, MA.
10. J. Shang, A. J. Smits, H. A. Stone, 2014. Drag on a liquid-infused superhydrophobic cylinder, *67th Annual Meeting, APS DFD*, San Francisco, CA.
9. M. Fu, H. A. Stone, A. J. Smits, I. Jacobi, M. Samaha, J. Wexler, J. Shang, B. Rosenberg, L. Hellström, Y. Fan, K. Wang, K. Lee, M. Hultmark, 2014. Liquid-infused surfaces in turbulent channel flow, *67th Annual Meeting, APS DFD*, San Francisco, CA.
8. M. Samaha, J. Shang, M. Fu, K. Wang, H. A. Stone, A. J. Smits, M. Hultmark, 2014. Measurements of drag reduction by SLIPS, *67th Annual Meeting, APS DFD*, San Francisco, CA.
7. J. K. Shang, B. Rosenberg, P. Dewey, H. A. Stone, and A. J. Smits, 2013. Flow around a superhydrophobic cylinder, *66th Annual Meeting, APS DFD*, Pittsburgh, PA.
6. M. Hultmark, H. A. Stone, A. J. Smits, I. Jacobi, M. Samaha, J. Wexler, J. K. Shang, B. Rosenberg, L. Hellstroem, Y. Fan, 2013. Drag reduction using slippery liquid infused surfaces, *66th Annual Meeting – APS DFD*, Pittsburgh, PA.
5. B. Rosenberg, M. A. Samaha, I. Jacobi, J. K. Shang, M. Hultmark, A. J. Smits, 2013. Longevity and drag reduction of omniphobic surfaces, *66th Annual Meeting, APS DFD*, Pittsburgh, PA.
4. J. K. Shang, H. A. Stone, and A. J. Smits, 2012. Characterization of vortex-induced vibration of a flexible cylinder, *65th Annual Meeting, APS DFD*, San Diego, CA.
3. B. Rosenberg, G. Arwatz, J. K. Shang, and A. J. Smits, 2012. Flow over slippery liquid-infused porous surfaces, *65th Annual Meeting, APS DFD*, San Diego, CA.

2. J. K. Shang, A. J. Smits, and H. A. Stone, 2011. A cantilevered flexible cylinder in cross-flow, *64th Annual Meeting, APS DFD*, Baltimore, MD.
1. J. K. Shang and H. Babinsky, 2010. Effect of low-amplitude vibrations on impulsively-started wings, *63rd Annual Meeting, APS DFD*, Long Beach, CA.

Video/Poster Presentations

6. N. Acharya, D. Polsin, H. Aluie, R. Betti, G. W. Collins, A. E. Gleason, J. R. Rygg, J. K. Shang, 2019. Hydrodynamic Design Simulations of XPiV-Compatible Targets using FLASH, *Annual Meeting, APS DPP*, Ft Lauderdale, FL.
5. C Cardinale, K Kindred, J Shang, 2020. Effect of Curvature on Whisker-Wake Interactions, *73rd Annual Meeting, APS DFD*, online.
4. Y. Liu, W. Gorman, C. Muir, J. Shang, 2018. Surface swimming using high-frequency, low-amplitude motions, *71st Annual Meeting, APS DFD*, Atlanta, GA.
3. J. K. Shang, H. A. Stone, and A. J. Smits, 2014. Flow around a superhydrophobic cylinder, *Purdue Prospective Faculty Workshop*, Lafayette, IN.
2. J. K. Shang, A. J. Smits, and H. A. Stone, 2012. Wakes and trajectories of a flexible cantilevered cylinder, *Fluid and Elasticity Conference*, La Jolla, CA.
1. J. Shang, M. Sullivan, and H. A. Stone, 2007. Hydrodynamic Cavitation: A Demonstration Suitable for the Classroom, *60th Annual Meeting, APS DFD*, Salt Lake City, UT.

Exhibits

2. Robotic fly prototype displayed at “Ecological Urbanism: Alternative and Sustainable Cities of the Future” symposium and exhibition. Harvard University Graduate School of Design, 3/30/09-5/17/09.
1. Robert J. Wood, Flybot robotic fly, in “Design and the elastic mind,” New York Museum of Modern Art, 2/24/08-5/12/08.

Funding & Support

Current/Pending

- | | |
|---------|---|
| pending | 1. High Energy Density Laboratory Physics, Department of Energy
PI |
| 2022 | 2. “Particle Tracking in HED Flows”
LLE-Laboratory Basic Science, FY2023
Co-PI
PIs: Danae Polsin (LLE) and Arianna Gleason (SLAC)
Date: August Award: OMEGA-60 facility time |
| 2021 | 3. “CAREER: Multiscale modeling of perivascular flow in the brain”
National Science Foundation (CBET Division)
PI
Dates: 12/15/2021 - 11/30/2026
Award: \$506,798 |
| 2021 | 4. “Viscosity measurements using tracer particles”
LLE-Laboratory Basic Science, FY2022
Co-PI
PIs: Danae Polsin (LLE) and Arianna Gleason (SLAC)
Date: August Award: OMEGA-60 facility time |
| 2021 | 5. “Tracking rarefaction with particle image velocimetry”
LLE-National Laser Users’ Facility, FY2022-2023
PI
Date: 06/01/2022
Award: OMEGA-EP facility time |

- 2021 6. “Shear viscosity measurements using multimodal modulated shock damping”
Center for Matter at Atomic Pressures solicitation, FY2022-2023
PI: Nitish Acharya (graduate student advisee)
Date: 06/02/2022
Award: OMEGA-EP facility time
- 2020 7. “Center for Matter at Atomic Pressures”
National Science Foundation Physics Frontier Center
Senior Personnel
PI: G. W. Collins (University of Rochester and LLE)
Dates: 8/1/2020 – 7/31/2025
Award: \$12,968,000
- 2019 8. “X-ray Particle Image Velocimetry for HED Science”
NNSA Stewardship Sciences Academic Alliance
PI
Co-PIs: Hussein Aluie (Univ. of Rochester), Arianna Gleason (SLAC)
Dates: 5/2019-4/2022
Award: \$521,442
- 2018 9. “Probing HED turbulence with lasers and coherent light sources”
DOE Office of Science, joint with NNSA
PI
Co-PIs: Hussein Aluie, J. Ryan Rygg, Riccardo Betti (Univ. of Rochester / LLE)
Dates: 8/2018-7/2022
Award: \$742,888

Previously awarded

- 2020 1. “Viscosity measurements using tracer particles”
LLE-Laboratory Basic Science, FY2020
Co-PI
PIs: Danae Polsin (LLE) and Arianna Gleason (SLAC)
Award: OMEGA-60 facility time
- 2019 2. “Viscosity measurements using tracer particles”
LLE-Laboratory Basic Science, FY2019
Co-PI
PIs: Danae Polsin (LLE) and Arianna Gleason (SLAC)
Award: OMEGA-EP facility time
- 2018 3. “A single propulsion paradigm for unmanned amphibious vehicles from sea to shore”
Office of Naval Research
PI
Dates: 3/1/2018 – 2/29/2020 (extended through Sept 2021)
Award: \$109,102
- 2017 4. “Age and AD related bottlenecks in glymphatic-lymphatic waste transport”
NIH National Institute for Aging
Co-PI
PI: Maiken Nedergaard (University of Rochester Medical Center)
Dates: 9/15/2017 – 3/30/2022
Award: \$3,232,244
- 2017 5. “Robotic Physics of Miniature Crawlers, Swimmers and Burrowers—Non-biological Locomotion Strategies in Complex Media”
University of Rochester University Research Award
Co-PI
PI: Alice Quillen (University of Rochester Physics & Astronomy)
Dates: 7/1/2017-6/30/2019
Award: \$40,000