

# Jessica K. Shang

Assistant Professor, Department of Mechanical Engineering  
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## Education

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**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, Churchill College** 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.
- Research Advisor: Robert J. Wood.

## Appointments

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**Assistant Professor of Mechanical Engineering** July 2016 – present  
*University of Rochester* Rochester, NY

- Affiliated with the *Institute for Matter at Extreme Energy Density (IMAXED)*
- Member of the *Center for Matter at Atomic Pressures* NSF Physics Frontier Center

**Scientist** October 2021 – present  
*Laboratory for Laser Energetics* Rochester, NY

**Postdoctoral Fellow** July 2015-June 2016  
*Stanford University School of Medicine* Stanford, CA

- Department of Pediatrics
- Stanford Cardiovascular Institute
- Advisor: Alison L. Marsden

## Honors and Awards

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

## Professional Affiliations

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American Physical Society: Division of Fluid Dynamics (DFD) and Plasma Physics (DPP)  
Society of Women Engineers (SWE)  
American Society of Mechanical Engineers (ASME)

## Peer-Reviewed Publications (students and postdocs underlined)

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22. D. S. Hodge, A. F. T. Leong, S. Pandolfi, P. Hart, E. Galtier, D. Khagani, S. Vetter, C. B. Curry, F.-J. Decker, H. J. Lee, D. S. Montgomery, **J. K. Shang**, H. Aluie, K. Kurzer-Ogul, B. Nagler, R. L. Sandberg, A. E. Gleason. Multi-frame, ultrafast, x-ray microscope for imaging shockwave dynamics, *Optics Express* 30, 38405-38422.
21. S. Pandolfi, T. Carver, D. S. Hodge, A. F. T. Leong, K. Kurzer-Ogul, K. Li, Y. Liu, A. Sakdinawat, S. Marchesini, P. Hart, E. Galtier, D. Khaghani, E. Cunningham, B. Nagler, H. J. Lee, C. Bolme, K. Ramos, P. M. Kozlowski, **J. K. Shang**, H. Aluie, D. S. Montgomery, R. L. Sandberg, A. E. Gleason. Novel fabrication tools for dynamic compression targets with engineered voids using photolithography methods, *Review of Scientific Instruments*, 93, 103502.
20. H. Aluie, S. Rai, H. Yin, A. Lees, D. Zhao, S. M. Griffies, A. Adcroft, **J. K. Shang**. Effective Drift Velocity from Turbulent Transport by Vorticity, *Physical Review Fluids*, 7, 10461.
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. doi: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. doi:10.1016/j.jtbi.2022.111103
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. doi:10.3847/2041-8213/ac0fe5
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** A10. 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. doi:10.1063/5.0043222
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. doi:10.1103/PhysRevFluids.5.054401 – *Editors' Suggestion*
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. doi:10.1115/1.4044333
12. J. H. Kim, R. Puranik, **J. K. Shang**, and D. M. Harris, 2019. Robust transferrable superhydrophobic surfaces, *Surface Engineering*, **36(6)** 614-620. 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. doi:10.1016/j.athoracsur.2018.10.024
10. J. H. Kim, J. P. Rothstein, and **J. K. Shang**, 2018. Dynamics of a flexible superhydrophobic surface during a drop impact, *Physics of Fluids*, **30** 072102. doi:10.1063/1.5028127 – *Selected as an AIP SciLight*
9. **J. K. Shang**, H. A. Stone, and A. J. Smits, 2018. Flow past a concave cylinder of constant curvature, *Journal of Fluid Mechanics*, **837** 896-915. doi:10.1017/jfm.2017.884

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 Journal for Pediatric & Congenital Heart Surgery*, **9** 157–170. doi:10.1177/2150135117745026
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, *Physics of Fluids*, **27** 052102. doi:10.1063/1.4921189
6. **J. K. Shang**, H. A. Stone, and A. J. Smits, 2014. Vortex and structural dynamics of a flexible cylinder in cross-flow, *Physics of Fluids*, **26** 053605. doi:10.1063/1.4878341
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, *Experiments in Fluids*, **55** 1805. doi:10.1007/s00348-014-1805-6
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, *Journal of Fluids & Structures*, **43** 481–486. doi:10.1016/j.jfluidstructs.2013.08.010
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, *Bioinspiration & Biomimetics*, **4** 036002. doi:10.1088/1748-3182/4/3/036002
2. B. O. Mysen and **J. Shang**, 2005. Evidence from olivine/melt element partitioning that nonbridging oxygen in silicate melts are not equivalent, *Geochimica Cosmochimica Acta*, **69** 2861–2875. doi:10.1016/j.gca.2004.12.028
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, *Geochimica Cosmochimica Acta*, **67** 3925–3936. doi:10.1016/S0016-7037(03)00262-X

## Refereed Conference Abstracts & Proceedings (students and postdocs underlined)

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8. J. B. Carr, A. Sefkow, and **J. Shang**, 2022. A 1-D pulse wave model coupling arterial and perivascular flow, *World Congress of Biomechanics*, hybrid (COVID-19).
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.

## Other Publications

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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*, invited; limited circulation.

## Invited Presentations

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14. Group on Shock Compression of Condensed Matter (GSCCM) Biennial Meeting (July 2022)
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)

## Conference Presentations (non-refereed) (postdocs and students underlined)

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22. A. Syeda, **J. Shang**, H. Aluie, N. Acharya, A. Gleason, D. Polsin, R. Betti, R. Rygg, G. W. Collins, J. J. Ruby, H. Pantell, D. Chin, 2022. Viscous Effects in Shock-Particle Interaction, *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter*, Anaheim, CA.
21. D. S. Hodge, et al., 2022. Implementation of an Ultrafast X-Ray Imager with an XFEL Multi-Pulse Train to Measure Void Collapse during Laser Driven Shock Compression, *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter*, Anaheim, CA.
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. Hellstrom, 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

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7. N. Acharya, D. Polsin, H. Aluie, R. Betti, G. W. Collins, J. R. Rygg, P. M. Celliers, **J. K. Shang**, 2022. Hydrodynamic simulations of rippled shock wave driven by laser ablation and initial pressure discontinuity, *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter*, Anaheim, CA.
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

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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.

## Service: International and National

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### Peer Review

- Journals: 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
- Panels: National Sciences and Engineering Research Council of Canada (NSERC), Department of Energy (DOE), National Science Foundation (NSF)

### Committees

- National Academy of Sciences study committee on *National Naval Responsibility & Engineering* for the Office of Naval Research, 2018-2019. Contributed to the report [“Toward New Naval Platforms: A Strategic View of the Future of Naval Engineering”](#).

### Conferences

- Program committee: APS Division of Plasma Physics 2023 meeting, HEDP subcommittee
- Meeting organizer, technical chair (2021 – present): Thousand Islands Fluid Dynamics Meeting. Brings together fluid dynamics research groups from the Northeast US and Canada.
- *Aneurysm biomechanics* session chair: Summer Biomechanics, Bioengineering, and Biotransport (SB3C) Meeting, 2016

## University Service

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- Department of Mechanical Engineering Committees
  - Diversity, Equity, and Inclusion, 2021-present
  - Graduate Admissions, 2016-2020
  - Graduate Studies, 2016-2020
- Faculty advisor for the University of Rochester chapter of the Society of Women Engineers (SWE), 2016-2021
- Undergraduate faculty advisor for the Mechanical Engineering Classes of 2021, 2025
- Ph.D. dissertation committees: Thomas Nevins \*19, Samuel Mellon \*19, Xin Bian \*21, Linda Crandall \*21

- Reviewer for University Research Awards, 2022

## Teaching

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### 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, 2022

### 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