

Suyi Li

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Academic Positions

Since 2016 **Assistant Professor** of Mechanical Engineering at Clemson University
2014-2015 **Postdoctoral Research Fellow** at the University of Michigan, Ann Arbor

Education

2014 Ph.D. in Mechanical Engineering, University of Michigan, Ann Arbor
2008 M.Sc. in Mechanical Engineering, Pennsylvania State University, University Park
2006 B.S. *Summa Cum Laude* in Mechanical Engineering, University of Michigan, Ann Arbor

Awards & Honors

2018c **CAREER Award**, National Science Foundation
2018b **CECAS Dean's Faculty Fellow Award**, Clemson University
2018a **Eastman Award for Excellence**, Clemson University
2016 **Best Paper Award** (lead-author), ASME Adaptive Structures and Material Systems Branch
2013 **Best Student Paper Award** (co-author), the Bio-inspiration, Bio-mimetics, and Bio-replication Conference of SPIE Smart Structures/NDE.
2009 **Best Paper Award** (co-author), ASME Adaptive Structures and Material Systems Branch
2006 **College of Engineering Fellowship**, Pennsylvania State University
2006 **Engineering Leadership Recognition**, UMich Student Space System Fabrication Lab

Publications

JOURNAL ARTICLES (26 IN TOTAL, AND SUYI'S STUDENTS ARE UNDERLINED)

- 2019f Geer R., Iannucci S. and **Li S.** “Robotic coiling actuator inspired by the awns of *Erodium cicutarium*”, under review by *Frontiers in Robotics and AI*.
- 2019e Bhovad P., Kaufmann, J. and **Li S.** “Peristaltic locomotion without digital controllers: Exploiting origami multi-stability to coordinate robotic motions”, *Extreme Mechanics Letter*, 32:100552. **Featured on the journal front cover**
- 2019d Fang H., **Li S.**, Thota, M., Xu J. and Wang K.W. “Origami lattices and folding-induced lattice transformations”, *Physical Review Research*, 1:023010.
- 2019c Lele A., Deshpande V., Myers O. and **Li S.** “Snap-through and stiffness adaptation of a multi-stable Kirigami composite module”, *Composites Science and Technology*, 182:107750.
- 2019b Sadeghi S. and **Li S.** “Fluidic origami with asymmetric quasi-zero stiffness for low-frequency vibration isolation”, *Smart Materials and Structures*, 28(6):065006.
- 2019a **Li S.**, Fang H., Sadeghi S., Bhovad P. and Wang K.W. “Architected origami materials: How folding creates sophisticated mechanical properties”, *Advanced Materials*, 31(5):1805282.
- 2018b Sane H., Bhovad P. and **Li S.** “Actuation performance of fluidic origami cellular structure: A holistic investigation”, *Smart Materials and Structures*, 27(11):115014.
- 2018a Sengupta. S and **Li S.** “Harnessing the anisotropic multistability of stacked-origami mechanical metamaterials for effective modulus programming”, *Journal of Intelligent Material Systems and Structures*, 29(14):2933–2945.
- 2017d Fang H., Wang K.W. and **Li S.** “Asymmetric Energy Barrier and Mechanical Diode Effect from Folding Multi-Stable Stacked Origami”, *Extreme Mechanics Letter*, 17:7-14.
- 2017c Fang H., **Li S.***, Ji H. and Wang K.W. “Dynamics of a bistable Miura-origami structure”, *Physical Review E*, 95:052211. (*Corresponding author)
- 2017b Thota M, **Li S.** and Wang K.W. “Lattice reconfiguration and phononic band-gap adaptation via origami folding”, *Physical Review B*, 95:064307.
- 2017a **Li S.** and Wang K.W. “Plant inspired adaptive structures and materials for morphing and actuation - A review”, *Bioinspiration and Biomimetics*, 12(1):011001.
- 2016c Fang H., **Li S.** and Wang K.W. “Self-locking degree-4 vertex origami structures”, *Proceedings of Royal Society A* 472:20160682.
- 2016b Fang H., **Li S.**, Ji H. and Wang K.W. “Uncovering the deformation mechanisms of origami metamaterials by introducing generic degree-four vertices”, *Physical Review E* 94:43002.
- 2016a **Li S.**, Fang H. and Wang K.W. “Recoverable and programmable collapse from folding pressurized origami cellular solids”, *Physical Review Letters* 117:114301.
- 2015d Fang H., **Li S.**, Xu J. and Wang K.W. “Phase coordination and phase-velocity relationship in a metameric locomotion system”, *Bioinspiration and Biomimetics* 106:066006.
- 2015c **Li S.** and Wang K.W. “Fluidic origami with embedded pressure dependent multi-stability”, *Journal of Royal Society Interface* 111(12):20150639.
- 2015b **Li S.** and Wang K.W. “Fluidic Origami: a plant inspired adaptive structure with shape morphing and stiffness tuning”, *Smart Materials and Structures* 24(10): 105031. **Elected as highlight of the year 2015 by the journal, and best paper award by ASME**
- 2015a **Li S.** and Wang K.W. “Architectural synthesis and analysis of dual cellular fluidic flexible matrix composites for multi-functional structures”, *ASME Journal of Mechanical Design* 137(4): 041402.

- 2014d **Li S.** and Wang K.W. “Synthesizing fluidic flexible matrix composite–based multicellular adaptive structure for prescribed spectral data”, *Journal of Intelligent Material Systems and Structures* 25(11): 1340-1351.
- 2014c Bruhn B., Schroeder T., **Li S.**, Billeh Y., Wang K.W. and Mayer M. “Osmosis-based pressure generation: dynamics and application”, *PLoS One* 9(3): e91350.
- 2014b Fang H., **Li S.**, Xu J. and Wang K.W. “A comprehensive study on the locomotion characteristics of a multi-segment earthworm-like robot. Part A: Modeling and gait generation”. *Journal of Multibody System Dynamics*, 34(4): 391-413.
- 2014a Fang H., C. Wang, **Li S.**, Xu J. and Wang K.W. “A comprehensive study on the locomotion characteristics of a multi-segment earthworm-like robot. Part B: Gait analysis and experiments”. *Journal of Multibody System Dynamics*, 35(2): 153-177.
- 2013 **Li S.** and Wang K.W. “On the synthesis of a bio-inspired dual-cellular fluidic flexible matrix composite adaptive structure based on a non-dimensional dynamics model”. **Featured article** in *Smart Materials and Structures* 22(1): 014001.
- 2011 **Li S.** and Wang K.W. “On the Dynamic Characteristics of Biological Inspired Multi-Cellular Fluidic Flexible Matrix Composite Structures”. *Journal of Intelligent Material Systems and Structures* 23(3): 291-300.
- 2009 Shan Y., Philen M., Lotfi A., **Li S.**, Bakis C. E., Rahn C. D. and Wang K.W. “Variable Stiffness Structures Utilizing Fluidic Flexible Matrix Composites”. *Journal of Intelligent Material Systems and Structures* 20(4): 443-456. **Best paper award by ASME.**

BOOK CHAPTER

- 2012 **Li S.** and Wang K.W. “Learning from plants – Recent advances in fluidic flexible matrix composite based multi-cellular and multi-functional adaptive structures”, a chapter in *Plants and Mechanical Motion – A Synthetic Approach to Nastic Structures and Materials*, edited by Wereley N. and Sater J., 115-140 ISBN-10: 1605950432.

CONFERENCE PROCEEDINGS (24 IN TOTAL, AND SUYI’S STUDENTS ARE UNDERLINED)

- 2019e Fedonyuk V., Bhovad P., **Li S.** and Tallapragada P. “Locomotion of an origami inspired Nonholonomic system”, *Proceeding of ASME DSCC*, Park City, Utah: DSCC2019-9016.
- 2019d Tao J. and **Li S.** “A high-fidelity dynamic model for origami based on iso-parametric Absolute Nodal Coordinate Formulation (iso-ANCF)”, *Proceeding of ASME SMASIS*, Louisville, KY: SMASIS2019-5534.
- 2019c Baharisangari N. and **Li S.** “Exploiting the asymmetric energy barrier in multi-stable origami to enable a mechanical diode behavior in compression”, *Proceeding of ASME IDETC/CIE*, Anaheim, CA: IDETC2019-97420.
- 2019b Sadeghi S., Bestill B. and **Li S.** “Design and optimization of an origami inspired jumping mechanism with nonlinear stiffness properties”, *Proceeding of ASME IDETC/CIE*, Anaheim, CA: IDETC2019-97706.
- 2019a Sadeghi S. and **Li S.** “Analyzing the bi-directional dynamic morphing of a bi-stable water-bomb base origami”, *Proceeding of SPIE SMART STRUCTURES/NDE*, Denver, Co: 10968-27.
- 2018d Geer R. and **Li S.** “Examining the coiling motion of soft actuators reinforced with tilted helix fibers”, *Proceeding of ASME SMASIS*, San Antonio TX, SMASIS2018-8038.

- 2018c Lele A., Myers O. and **Li S.** “Fabrication and testing of Kirigami-inspired multi-stable composites”, *Proceeding of ASME SMASIS*, San Antonio TX, SMASIS2018-7981.
- 2018b Sadeghi S., Betsill B., Tallapragada P. and **Li S.** “The effect of nonlinear spring in jumping mechanisms”, *Proceeding of ASME DSCC*, Atlanta, GA: DSCC2018-8969. **Finalist in Best Student Paper Award Competition.**
- 2018a Bhovad P. and **Li S.** “Using multi-stable origami mechanism for peristaltic gait generation: A case study”, *Proceeding of ASME IDETC/CIE*, Quebec City, Canada: IDETC2018-85932.
- 2017c Sadeghi S. and **Li S.** “Harnessing the quasi-zero stiffness from fluidic origami for low frequency vibration isolation”, *Proceeding of ASME SMASIS*, Snowbird UT, SMASIS2017-3754. **Finalist in Best Student Paper Award Competition.**
- 2017b **Li S.** “Anisotropic, Adaptive, and Asymmetric Multi-Stability From Origami Folding”, *Proceeding of ASME IDETC/CIE*, Cleveland, OH: IDETC-67285.
- 2017a Sengupta S. and **Li S.** “Multi-stability and variable stiffness of cellular solids designed based on origami patterns”, *Proceeding of SPIE SMART STRUCTURES/NDE*, Portland, OR: 10164-77.
- 2016c Thota M., **Li S.** and Wang K.W. “Origami metastructures with tunable wave propagation”, *Proceeding of ASME SMASIS*, Stowe, VT: SMASIS2016-9186.
- 2016b **Li S.**, Fang H. and Wang K.W. “Pressurized origami structure for programmable negative and quasi-zero stiffness,” *Proceeding of ASME IDETC/CIE*, Charlotte, NC: IDETC-59409.
- 2016a Fang H., **Li S.**, Xu J. and Wang K.W. “Locking mechanisms in degree-4 vertex origami structures,” *Proceeding of SPIE SMART STRUCTURES/NDE*, Las Vegas, NV: 979910.
- 2015 **Li S.** and Wang K.W. “Fluidic origami cellular structure: combining the plant nastic movements with paper folding art”, *Proceeding of SPIE SMART STRUCTURES/NDE*, San Diego, CA: 94310H.
- 2014 Fang H., Wang C., **Li S.**, Xu J. and Wang K.W. “Design and experimental gait analysis of a multi-segment in-pipe robot inspired by earthworm’s peristaltic locomotion”, *Proceeding of SPIE SMART STRUCTURES/NDE*, San Diego, CA: 90550H. **Best student paper award**
- 2013b Fang H., **Li S.** Wang K.W. and Xu J. “Locomotion gait design of an earthworm-like robot based on multi-segment fluidic flexible matrix composite structures”. *Proceeding of ASME SMASIS*, Snowbird, Utah: SMASIS2013-3027: V002T06A003.
- 2013a **Li S.** and Wang K.W. “Synthesizing fluidic flexible matrix composite based cellular structures”. *Proceeding of SPIE SMART STRUCTURES/NDE*, San Diego, CA: 86880H.
- 2010b **Li S.** and Wang K.W. “On the dynamics of fluidic flexible matrix composite cellular structures”. *21th International Conference on Adaptive Structure Technology*, State College, PA.
- 2010a Kim G.W., **Li S.**, and Wang K.W. “Variable stiffness actuator based on fluidic flexible matrix composites and piezoelectric-hydraulic pump”. *Proceedings of SPIE SMART STRUCTURES/NDE*, San Diego, CA: 76431Y.
- 2009 Lotfi A., Shan Y., **Li S.**, Rahn C. D., Bakis C. E. and Wang K.W. “Stiffness shaping for zero vibration fluidic flexible matrix composites”. *Proceedings of ASME SMASIS*, Ellicott City, Maryland: SMASIS2008-501: 409-417.
- 2008 **Li S.**, Lotfi A., Shan Y., Wang K.W., Rahn C.D., and Bakis C. E. “A variable transverse stiffness sandwich structure using fluidic flexible matrix composites (F²MC)” *Proceedings of SPIE SMART STRUCTURES/NDE* San Diego, CA: 69280M.

2007 Shan Y., Lotfi A., Philen M., **Li S.**, Bakis C.E., Rahn C.D. and Wang K.W. “Fluidic flexible matrix composites for autonomous structural tailoring” *Proceedings of SPIE SMART STRUCTURES/NDE* San Diego, CA: 652517.

Inventions and Patents

2019 U.S. Patent: “Origami Sonic Barrier for Traffic Noise Mitigation”, with M. Thota and K.W. Wang (US Application No. 16/135,538).

2015 University of Michigan invention disclosure: “Fluidic Origami for Rapid Shape Morphing/Actuation and Mechanical Property Tuning”, with K.W. Wang.

Media Coverage

2018 **Eurekalert** “Origami mysteries could be unfolded in engineering research”

2018 **Clemson Newsstand** “Meet a Tiger: Suyi Li”

2011 **U.S. News** “Plants that can move inspire new adaptive structures”

Funded Research

SECURED FUNDING SINCE 2016: \$1.8 MILLION (SUYI’S SHARE: \$1.4 MILLION)

Current **National Science Foundation:** “Exploiting Multi-Stability to Enable A Mechanical Intelligence for Soft Robotic Motion Coordination and State-Space Reconfiguration” CMMI-1933124 (DCSD Program), Role: PI, \$275,894 (100%).

National Science Foundation: “Establishing a Design Framework for Multi-functional Composites by Leveraging Kirigami Cutting, Multi-stability, and Multi-level Optimizaiton”, CMMI-1760943 (ESD Program), Role: Lead-PI, Date: 08/07/2018-08/31/2021, \$715,182 (40%).

National Science Foundation: “CAREER: Leveraging the Three-Dimensional Multi-Stability from Origami Folding to Synthesize Multi-Functional Material Systems”, CMMI-1751449 (MOMS Program), Role: PI, Date: 05/01/2018-04/30/2023, \$500,000 main award and \$98,569 supplement (100%).

Completed **National Science Foundation:** “Uncovering the Dynamic Characteristics and Functionality of Generic Origami Structures and Materials” CMMI-1633952 (DCSD Program), Role: PI, Date: 09/01/2016-08/31/2019, \$192,604 (100%).

Invited Seminars and Workshops

2019 “Origami robotics: Folding intelligent machines,”

Guest lecture at Georgia Institute of Technology, Department of Civil Engineering

2019 “How to use origami principle to architect desirable structure and material properties,”

Short course at ASME SMASIS Conference on Smart Materials, Adaptive Structures and Intelligent Systems

- 2019 “Mechanics under the fold: How origami creates sophisticated mechanical properties,”
Seminar at Auburn University, Department of Aerospace Engineering,
- 2018 “Mechanics under the fold: How origami creates sophisticated mechanical properties,”
Seminar at University of Connecticut, Department of Mechanical Engineering.
- 2016b “From Venus flytrap to Morphing Wings: A review of plant inspired adaptive structures
and smart materials for shape morphing and actuation,”
Seminar at Clemson University, Department of Biological Science.
- 2016a “Origami: From paper folding art to innovative adaptive structures,”
Seminar at Florida State University, Department of Mechanical Engineering.
- 2015 “Learning from plants: Bio-inspired multi-functional cellular adaptive structures,”
Seminar at Clemson University, Department of Mechanical Engineering.

Current Advisees

PH.D. CANDIDATES (WITH EXPECTED YEAR OF GRADUATION)

- 2021 Sahand Sadeghi, “Uncovering the dynamic characteristics of origami folding and its potential applications”.
- 2022 Priyanka Bho vad, “Embedding and exploiting multi-stability in compliant robotic skeletons for a mechanical intelligence”.
- 2022 Jiayue Tao, “Towards an accurate and computationally efficient modeling of the nonlinear dynamics and mechanics of folded structures and material systems”.
- 2022 Hesam Khosravi, “Infusing Kirigami principle into the design and property programming of adaptive composite structures”.
- 2023 Vishrut Deshpande, “Transient dynamics of snap-through in multi-stable shells”.

THESIS MASTER STUDENTS (WITH EXPECTED YEAR OF GRADUATION)

- 2020 Nasim Baharisangari, “Bi-directional static diodic behaviors of a multi-stable origami cellular structure”.
- 2020 Joshua Kaufmann, “Reconfigurable and quasi-articulated soft manipulator featuring elastic multi-stability”.
- 2021 Steven Iannucci, “Designing Kirigami skins to enable programmed manipulation in soft robotic actuators”.
- 2021 Reese Allison, “On the experimental investigation of origami jumpers with prescribed nonlinear stiffness for enhanced energy storage”.

UNDERGRADUATE HONOR THESIS STUDENTS (WITH EXPECTED YEAR OF GRADUATION)

- 2020 Graham Jackson, “Using dynamic vibration to enable rapid self-folding”.

Advised Thesis

- 2019b Ryan Geer, “Analyzing the Coiling and Uncoiling motion of Soft Actuators with Tilted Helix Fiber Reinforcement”, Master Thesis.

- 2019a Blake Bestill, “Using Origami Folding Techniques to Study the Effect of Nonlinear Stiffness on the Performance of Jumping Mechanisms”, Master Thesis.
- 2018 Aditya Lele, “Snapping Behaviors and Stiffness Properties of an Kirigami Composite Unit Cell”, Master Thesis (co-advisor).
- 2017b Hrishikesh Sane, “A Holistic Investigation and Implementation of Fluidic Origami cellular Solid for Morphing and Actuation”, Master Thesis.
- 2017a Sattam Sengupta, “Multi-Stability and Variable Stiffness of Cellular Solids based on Origami Patterns”, Master Thesis.

Teaching

- Undergrad **ME4030** “Control and Integration of Multi-Domain Dynamic Systems”:
 Spring 2016 (39 students), Fall 2016 (69 students), Spring 2017 (35 students),
 Fall 2017 (94 students), Spring 2018 (40 students), Fall 2018 (73 students)
 Spring 2018 (25 students), Fall 2019 (43 students).
- ME4020** “Senior Capstone Design”:
 Spring 2018 (20 students).
- Graduate **ME8450** “Structural Vibration”:
 Spring 2018 (13 students).

Service & Affiliation

PROFESSIONAL SERVICE

- Reviewer
- Advanced Materials
 - Applied Materials Today
 - Advanced Theory and Simulations
 - Applied Physics Letter
 - Bioinspiration & Biomimetics
 - Composites Science and Technology
 - International Conference on Robotics and Automation (ICRA),
 - Journal of Applied Physics
 - Journal of Composites Part B
 - Journal of Engineering Mechanics
 - Journal of Mechanical Design
 - Journal of Intelligent Materials Systems and Structures
 - Journal of Royal Society
 - Journal of Thin-Walled Structures
 - Materials & Design
 - Material Research Express
 - Soft Robotics
 - Structures
 - Smart Materials and Structures

Symposium Chair	Symposium on the “Dynamics of Soft Media and Robotics” in 2019 ASME International Design Engineering Technical Conferences (IDETC)
Session Chair	SPIE Smart Structures + Nondestructive Evaluation Conference (2016, 2017, 2018) ASME International Design Engineering Technical Conferences (IDETC) (2017, 2018) ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMA-SIS) (2016, 2017)
Secretary	Adaptive Systems Dynamics and Controls Technical Committee in the Branch of Adaptive Structures and Material Systems, ASME Aerospace Division
Committee member	Branch Committee, Adaptive Structures and Material Systems, ASME Aerospace Division Technical Committee of Vibration and Sound, ASME Design Division Program Committee of SPIE Smart Structures/NDE Conference
Panelist	National Science Foundation, 2017, 2018
Proposal Reviewer	National Science Foundation, 2019 Dutch Research Council (NWO), 2019

DEPARTMENT SERVICE

Committee Member	Ad-hoc Bylaw Committee (2019-2020) Curriculum Committee (2019-2020) Seminar and Computer Utilization Committee (2016-2018) Ad-hoc Research Cluster Formation Committee (2018-2019) New Faculty Search Committee (2019)
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