

FENG LING

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PERSONAL INFO

Birth Year: 1992
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EDUCATION

- 2016 - 2022 **University of Southern California**, Los Angeles, CA
Ph.D., Mechanical Engineering (*Defense on 02/18/2022, Degree conferred 05/13/2022*)
Title: Multiscale Modeling of Cilia Mechanics and Functions
Committee: *Prof. Eva Kanso, Prof. P. Newton, Prof. I. Bermejo-Moreno, Prof. A. Oberai, Prof. C. Hasehwandter*
- 2010 - 2015 **The University of Texas at Austin**, Austin, TX
B.S. Pure Mathematics, December 2015
B.S. Aerospace Engineering (Astronautics), December 2015
Computational Science and Engineering Certificate Program, May 2015 (*Rene Hiemstra, Prof. T. J.R. Hughes*)
Halliburton Business Foundations Summer Institute, July 2012

EMPLOYMENT

- 2022 - **Postdoctoral Researcher**, Nawroth Mechanobiology, Helmholtz Pioneer Campus, PI: *Dr. Janna Nawroth*
2021 **Teaching Assistant**, Computational Solutions to Engineering Problems (AME 404), *Dr. Takahiro Sakai*
2017 - 2022 **Research Assistant**, Bio-Inspired Motion Lab at USC, PI: *Prof. Eva Kanso*
2016 **Teaching Assistant**, Engineering Thermodynamics (AME 310), *Prof. J. Domaradzki and A. Penkova*
2013 - 2015 **Research Assistant**, Center for Space Research at UT Austin, PI: *Prof. Srinivas Bettadpur*

PUBLICATIONS

- 2023 9. S. Heydari, **F. Ling**, Y. Jiao, J. Merel, M. J. McHenry, and E. Kanso,
Learning tube feet control for sea star locomotion, (*in preparation*)
8. C. Huang, **F. Ling**, Y. Man, and E. Kanso,
Collective behavior of circularly-confined fish schools, (*in preparation*)
7. **F. Ling**, Y. Man, and E. Kanso,
Flagellar wave reversal via forward-aft molecular motor asymmetry, (*in preparation*)
6. J.C. Nawroth, **F. Ling**, K. Katija, D. Stein, M.S. Shelley, and E. Kanso, (joint first author),
Flow Physics Explains Morphological Diversity of Ciliated Ducts, (*under review*)
- 2022 5. A.V. Kanale, **F. Ling**, H. Guo, S.F. Fürthauer, E. Kanso, (joint first author),
Spontaneous Phase Coordination in Model Ciliary Carpets, *PNAS* 119(45) e2214413119
- 2021 4. Y. Jiao, **F. Ling**, S. Heydari, N. Heess, J. Merel, and E. Kanso, (joint first author),
Learning to swim in potential flow, *Phys. Rev. Fluids*. 6(5):050505
3. **F. Ling** and E. Kanso, **Octopus-Inspired Arm Movements**,
Bioinspired Sensing, Actuation, and Control in Underwater Soft Robotic Systems Ch. 11
- 2019 2. Y. Man, **F. Ling**, and E. Kanso, (equal contributions),
Cilia Oscillations, *Phil. Trans. R. Soc. B*, 375:20190157.
- 2018 1. **F. Ling**, H. Guo, and E. Kanso, **Instability-driven oscillations of elastic microfilaments**,
J. R. Soc. Interface 15:20180594.

RESEARCH INTERESTS/EXPERIENCES

- 2022 - **Microrheology of Human Airway Mucus and its Role in Airway Barrier Function**, PI: *Dr. Janna Nawroth*
joint with *Prof. Oliver Lieleg, Bernardo Miller-Naranjo, Prof. Stefano Aime, Francesco Bacchi, Dr. Emanuele Pontecorvo, Doris Roth, Ayse Tuğçe Şahin*
Leverage innovative optical microscopy methods (*e.g.* Differential Dynamic Microscopy for micro-rheology), physics-based computational modeling, and machine learning techniques to dissect different factors that cause mucociliary clearance impairment in chronic airway diseases (*e.g.* COPD, IPF, Asthma)
- 2017 - 2022 **Mechanics and Coordination of Cilia/Eukaryotic Flagella**, PI: *Prof. Eva Kanso*
joint with *Dr. Yi Man, Dr. Janna Nawroth, Anup Kanale*
Attack the multi-scale cilia coordination problem via a consortium of models that deal with mechanics of

- molecular motors, treat ciliary carpets and ducts as phased oscillators and active porous media
- 2019 - 2022 **Understanding Locomotion and Collective Behaviors**, advised by *Prof. Eva Kanso, Dr. Josh Merel*
joint with *Yusheng Jiao, Chenchen Huang, Sina Heydari*
Using reduced-order models and reinforcement learning techniques to study the formation of locomotion gaits and gait transitions in fish and multi-legged animal and emergence of collective motion from microscopic cilia to fish schools
- 2018 **Trade-offs in Rapid Plant Movements (MSRI-Janelia)**, advised by *Prof. Orit Peleg, Dr. Mattia Serra*
joint with *Samantha Hill, Nina Ning*
Mathematical analysis of drag reduction due to branch folding in *Mimosa Pudica*
- 2016 - 2019 **Discrete Inverse Spectral Problem**, supervised by *Prof. Etienne Vouga* and *Prof. Keenan Crane*
Reconstruction of discrete genus-0 surfaces using only its Laplace-Beltrami spectrum
- 2013 - 2015 **At Center for Space Research**, supervised by *Prof. Srinivas Bettadpur*
Parametric modeling of spacecraft accelerometer and center-of-mass misalignment
Correlation analysis among accelerometer read-outs, thruster firing pattern, and star camera anomalies
Studied geographical significance of GRACE on-board SNR w.r.t. gravity model post-fit residue

AWARDS/HONOR

- 2022 **Jenny Wang Excellence in Teaching Award**, AME 404
- 2021 **AES Student MATLAB plugin Competition 2nd Place**, Synchronized Sythesis: A music synthesizer enabled by the synchronization of many ($\geq \mathcal{O}(10^3)$) coupled phased oscillators.
- 2015 **Meritorious Winner Team Lead**, COMAP Mathematical Contest In Modeling
Problem B: Searching a lost aeroplane in open water, locally organized by *Dr. Andrew Spann*
- 2011 **Member**, $\Sigma\Gamma\Gamma$ Aerospace Honor Society UT Austin Chapter
- 2010 **Finalist**, Intel International Science and Engineering Fair

TALKS/PRESENTATIONS

- 2023 **American Physical Society (APS) March Meeting**, Flow Physics Explains Morphological Diversity of Ciliated Organs, PP08.8
Gordon Research Conference (GRC): Cilia, Mucus and Mucociliary Interactions, Poster: Flow Physics Explains Morphological Diversity of Ciliated Organs
- 2022 **APS March Meeting**, Cilia Coordination (substitute presentation for *Prof. Eva Kanso's* invited talk M07:5)
- 2021 **APS Division of Fluid Dynamics Meeting (DFD)**, Asymmetric driving forces and spatial heterogeneity enhance metachronal order in ciliary carpets
Janelia 4D Cellular Physiology Workshops, Sponatenous coordination of ciliary carpets remastered version
- 2020 **Course lecture**, Mechanics of morphogenesis: surface growth and patterns
- 2019 - 2020 **APS DFD**, Proximal-to-distal molecular motor asymmetry controls flagellar wave reversals
SHINE USC (for HS students), Experiments on the fantastic strangeness of viscosity and elasticity
- 2018 **APS DFD**, Ciliary pumps
APS March Meeting, Instability-driven oscillations of active microfilament
- 2017 **APS DFD**, Dynamics of active microfilaments
- 2016 **Mathematics Undergraduate Student Talks** (at UT Austin), LS category and its cousins
- 2015 **Introduce a Girl to Engineering Day** (with demonstrations for K-12 audience),
Ballon rockets and iterative engineering design
Directed Reading Program (DRP), (Co)fiber sequences and $\pi_3(S^2)$, mentor: *Ernest Fontes*
DRP, What is persistent homology, mentor: *Abmad Issa*
- 2014 **DRP**, Čech cohomology of projective spaces, mentor: *Yuecheng Zhu*
DRP, Classification of du-val singularities, mentor: *Yuecheng Zhu*
- 2013 **DRP**, How to blow-up double points in a plane, mentor: *Hendrik Orem*

MISC. ASSOCIATIONS

- COVID Yet another bouldering fanatic in the making and can now officially juggle and play with DAWs
- 2019 - 2022 Judging for USC Undergraduate Symposium for Scholarly and Creative Work (Physical Sciences II)
- 2018 - 2020 Designated pot washer for Good Karma Cafe at USC (volunteer \rightarrow part of the family)
- 2017 USC Wrigley Marine Science Institute Spring Break Program on Sustainability
- 2016 - 2020 DTLA Weightlifting (defeated by strange back issues and distracted by bouldering)
- 2016 Volunteering in SXSW comedy and planning operations crew
- 2014 - 2016 Participation in Texas Undergraduate Topology and Geometry conference
- 2013 - 2016 Active member of Math Club at UT Austin (should've bought a shirt to show off)

2013	Researched WAAS literature for UT Radionavigation Lab over the summer
2011 - 2020	Numerous experiences in MOOC learning on Cryptography, Software Testing, Machine Learning, Database Management, AI, Automata Theory, Epigenetics, Origins of Life...
2011 - 2014	Longhorn Rocket Association (model rockets and software ground station work for a L2 rocket)
2014	LeaderShape Institute participant
2010 - 2011	Member of Engineering for a Sustainable World, IEEE Robotics and Automation Society; Explore UT Guide; Austin Habitat for Humanity (helped roofed and fenced a house)
2007 - 2009	Volunteer work at Houston Methodist Hospital and Bellaire City Library

ELECTIVE GRADUATE COURSEWORK

	at University of Southern California
2020	Physics of Emergent Phenomena, <i>Prof. Christoph Haselwandter</i> Computational Differential Geometry, <i>Prof. Anand Joshi</i>
2018	Transition to Chaos in Dynamical Systems, <i>Prof. Paul Newton</i> Mechanics of Locomotion in Air, Water, and on Land, <i>Prof. Eva Kanso</i>
2017	Thermodynamics and Statistical Mechanics, <i>Prof. Christoph Haselwandter</i> Incompressible Fluids and Turbulence, <i>Prof. Mitul Lahar</i>
2016	Fokas method (audit), <i>Prof. Athanassios Fokas</i>
	at the University of Texas at Austin
	Kac-Moody Algebras and Groups (audit), <i>Prof. Daniel Allcock</i> Algebraic Geometry (audit), <i>Prof. David Ben-Zvi</i> Riemann Surfaces (audit), <i>Prof. Tim Perutz</i> Moduli of Higgs Bundle (audit), <i>Prof. Andrew Neitzke</i>
2015	Algebra, <i>Prof. Felipe Voloch</i> K-theory as it appears in geometry, <i>Prof. Dan Freed</i> Topics in algebraic topology (individual instruction), <i>Prof. Andrew Blumberg</i> 4-Manifold Topology (audit), <i>Prof. Robert Gompf</i> Rational Homotopy Theory (audit), <i>Dr. Jonathan Campbell</i> Differential Topology, <i>Prof. Andrew Neitzke</i> D-modules (audit), <i>Dr. Sam Gunningham</i> Ergodic Theory and Dynamics (audit), <i>Prof. Lewis Bowen</i>
2014	Real Analysis, <i>Prof. Lewis Bowen</i> Algebraic Topology, <i>Prof. Michael Starbird</i> Homotopy Type Theory (audit), <i>Prof. Andrew Blumberg</i> Complex Analysis, <i>Prof. Thomas Chen</i> Stochastic Detection and Estimation, <i>Prof. Todd Humphreys</i>
2013	Finite Elements Methods, <i>Prof. Mary Wheeler</i> GPS Signal Processing, <i>Prof. Todd E. Humphreys</i>