FENG LING

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PERSONAL INFO

Birth Year: 1992
Citizenship: China, People's Republic of
E-mail: Feng.Ling@helmholtz-muenchen.edu
ORCID: 0000-0002-1766-073X
Address: Lerchenauerstraße 4, D-80809 München
Mobile: +49 1515 597 4990 / +1 713 666 2935
Webpage: http://gofling.me/
Google Scholar: link to profile page

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. Haselwandter*

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,
Flow Physics Explains Morphological Diversity of Ciliated Ducts, *(under review)*
2022 5. A.V. Kanale, F. Ling, H. Guo, S.F. Fürthauer, E. Kanso,
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,
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, 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, Ayşe 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 **2nd Place,** AES Student MATLAB plugin Competition. 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**, ΣΓΤ 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: *Ahmad 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 - 2020 Judging for USC Undergraduate Symposium for Scholarly and Creative Work
2018 - 2020 Designated pot washer for Good Karma Cafe at USC (volunteer → 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, *Prof. Christoph Haselwandter*
	Computational Differential Geometry, *Prof. Anand Joshi*
2018	Transition to Chaos in Dynamical Systems, *Prof. Paul Newton*
	Mechanics of Locomotion in Air, Water, and on Land, *Prof. Eva Kanso*
2017	Thermodynamics and Statistical Mechanics, *Prof. Christoph Haselwandter*
	Incompressible Fluids and Turbulence, *Prof. Mitul Luhar*
2016	Fokas method (audit), *Prof. Athanassios Fokas*
	at the University of Texas at Austin
	Kac-Moody Algebras and Groups (audit), *Prof. Daniel Allcock*
	Algebraic Geometry (audit), *Prof. David Ben-Zvi*
	Riemann Surfaces (audit), *Prof. Tim Perutz*
	Moduli of Higgs Bundle (audit), *Prof. Andrew Neitzke*
2015	Algebra, *Prof. Felipe Voloch*
	K-theory as it appears in geometry, *Prof. Dan Freed*
	Topics in algebraic topology (individual instruction), *Prof. Andrew Blumberg*
	4-Manifold Topology (audit), *Prof. Robert Gompf*
	Rational Homotopy Theory (audit), *Dr. Jonathan Campbell*
	Differential Topology, *Prof. Andrew Neitzke*
	D-modules (audit), *Dr. Sam Gunningham*
	Ergodic Theory and Dynamics (audit), *Prof. Lewis Bowen*
2014	Real Analysis, *Prof. Lewis Bowen*
	Algebraic Topology, *Prof. Michael Starbird*
	Homotopy Type Theory (audit), *Prof. Andrew Blumberg*
	Complex Analysis, *Prof. Thomas Chen*
	Stochastic Detection and Estimation, *Prof. Todd Humphreys*
2013	Finite Elements Methods, *Prof. Mary Wheeler*
	GPS Signal Processing, *Prof. Todd E. Humphreys*