

MITUL LUHAR

Henry Salvatori Early Career Chair
Assistant Professor of Aerospace and Mechanical Engineering
University of Southern California

luhar@usc.edu
<http://sites.usc.edu/fsi>

EDUCATION

Massachusetts Institute of Technology (MIT) Cambridge, MA
Ph.D., Civil and Environmental Engineering September 2012
Thesis: Analytical and Experimental Studies of Plant-Flow Interaction at Multiple Scales
Advisor: Heidi M. Nepf

Queens' College, University of Cambridge Cambridge, UK
B.A. (Hons), Engineering June 2007
M.Eng. (Distinction), Mechanical Engineering June 2007

APPOINTMENTS

University of Southern California (USC) Los Angeles, CA
Henry Salvatori Early Career Chair in Engineering 2020-present
Assistant Professor of Aerospace and Mechanical Engineering (AME) 2015-present
Assistant Professor of Civil and Environmental Engineering (CEE; courtesy) 2015-present

California Institute of Technology (Caltech) Pasadena, CA
Postdoctoral Scholar, Graduate Aerospace Laboratories 2012-2014

HONORS

Invited Participant, US Frontiers of Engineering Symposium, National Academy of Engineering 2020
CAREER Award, National Science Foundation (NSF) 2020
Young Investigator Program Award, Air Force Office of Scientific Research (AFOSR) 2017
Letter of Commendation for Excellence in Teaching, MIT 2011
Martin Family Society Fellow for Sustainability, MIT 2009
Edward H. Linde Presidential Fellow, MIT 2007-2008
Fellow of the Cambridge Commonwealth Trust, University of Cambridge 2003-2007
Foundation Scholar, Queens' College, University of Cambridge 2005

For the sections below, an asterisk () denotes a student advised at USC.*

JOURNAL PUBLICATIONS

31. M. Hermes* and **M. Luhar** (2021) Sea star body shapes generate downforce, *Scientific Reports*, accepted.
30. A. Chavarin*, G. Gomez-de-Segura, R. Garcia-Mayoral, and **M. Luhar** (2021) Resolvent-based predictions for turbulent flow over anisotropic permeable substrates, *Journal of Fluid Mechanics*, accepted.
<https://arxiv.org/abs/2006.01378>
29. A. Chavarin*, C. Efstathiou*, S. Vijay*, and **M. Luhar** (2020) Resolvent-based design and experimental testing of porous materials for passive turbulence control, *International Journal of Heat and Fluid Flow*, 86: 108722.
<https://doi.org/10.1016/j.ijheatfluidflow.2020.108722>
28. **M. Luhar** (2020) Comment on "The wave-driven current in coastal canopies" by M. Abdolahpour et al., *Journal of Geophysical Research: Oceans*, accepted.
<https://arxiv.org/abs/2005.02855>
27. C.V. Krishna*, M. Wang, M. Hemati, and **M. Luhar** (2020) Reconstructing the time evolution of wall-bounded turbulent flows from non-time resolved PIV measurements, *Physical Review Fluids*, 5, 054604. (*Editors' Sug-*

gestion)

<https://doi.org/10.1103/PhysRevFluids.5.054604>

26. A. Chavarin* and **M. Luhar** (2020) Resolvent Analysis for Turbulent Channel Flow with Riblets, *AIAA Journal*, 58(2): 589–599.
<https://doi.org/10.2514/1.J058205>
25. M. Ishida, D. Drotman, B. Shih, M. Hermes*, **M. Luhar**, and M. T. Tolley (2019) Morphing Structure for Changing Hydrodynamic Characteristics of a Soft Underwater Walking Robot, *IEEE Robotics and Automation Letters*, 4(4), 4163–4169.
<https://doi.org/10.1109/LRA.2019.2931263>
24. S. Toedtli, **M. Luhar**, and B.J. McKeon (2019) Predicting the response of turbulent channel flow to varying-phase opposition control: Resolvent analysis as a tool for flow control design, *Physical Review Fluids*, 4(7), 073905.
<https://doi.org/10.1103/PhysRevFluids.4.073905>
23. A. Kawagoe, S. Nakashima, **M. Luhar**, and K. Fukagata (2019) Proposal of control laws for turbulent skin-friction reduction based on resolvent analysis, *Journal of Fluid Mechanics*, 866: 810–840.
<https://doi.org/10.1017/jfm.2019.157>
22. Y. Li, H. Mao, P. Hu, M. Hermes*, H. Lim, J. Yoon, **M. Luhar**, Y. Chen, and W. Wu (2019) Bio-inspired Functional Surfaces Enabled by Multiscale Stereolithography, *Advanced Material Technologies*, 4(5), 1800638.
<https://doi.org/10.1002/admt.201800638>
21. S. Nakashima, **M. Luhar**, and K. Fukagata (2019) Reconsideration of spanwise rotating turbulent channel flows via resolvent analysis, *Journal of Fluid Mechanics*, 861: 200–222.
<https://doi.org/10.1017/jfm.2018.894>
20. D. Sarkar, W. Wang, M. Mecklenberg, A. Clough, M. Yeung, C. Ren, Q. Lin, L. Blankemeier, S. Niu, H. Zhao, H. Shi, H. Wang, S. Cronin, J. Ravichandran, **M. Luhar**, and R. Kapadia (2018) Confined liquid-phase growth of crystalline compound semiconductors on any substrate, *ACS Nano*, 12(6): 5158–5167.
<https://doi.org/10.1021/acsnano.8b01819>
19. **M. Luhar** (2018) Turbulence: Peace in the pipeline, *Nature Physics*, 14(4): 336.
<https://doi.org/10.1038/s41567-017-0037-0>
18. Y. Huang, L. Ristroph, **M. Luhar**, and E. Kanso (2018) Bistability in the rotational motion of rigid and flexible flyers, *Journal of Fluid Mechanics*, 849: 1043–1067.
<https://doi.org/10.1017/jfm.2018.446>
17. C. Efstathiou* and **M. Luhar** (2018) Mean turbulence statistics in boundary layers over high-porosity foams, *Journal of Fluid Mechanics*, 841: 351–379.
<https://doi.org/10.1017/jfm.2018.57>
16. **M. Luhar** (2017) Soft materials: A remedy for thinning hair, *Nature Physics*, 13(10): 927.
<https://doi.org/10.1038/nphys4247>
15. **M. Luhar**, E. Infantes and H. Nepf (2017) Seagrass blade motion under waves and its impact on wave decay, *Journal of Geophysical Research: Oceans*, 122(5): 3736–3752.
<https://doi.org/10.1002/2017JC012731>
14. S. Nakashima, K. Fukagata and **M. Luhar** (2017) Assessment of suboptimal control for turbulent skin friction reduction via resolvent analysis, *Journal of Fluid Mechanics*, 828: 496–526.
<https://doi.org/10.1017/jfm.2017.519>
13. **M. Luhar**, A.S. Sharma and B.J. McKeon (2016) On the design of optimal compliant walls for turbulence control, *Journal of Turbulence*, 17: 787–806
<https://doi.org/10.1080/14685248.2016.1181267>
12. **M. Luhar** and H. Nepf (2016) Wave-induced dynamics of flexible blades, *Journal of Fluids and Structures*, 61: 20–41
<https://doi.org/10.1016/j.jfluidstructs.2015.11.007>

11. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2015) A framework for studying the effect of compliant surfaces on wall turbulence, *Journal of Fluid Mechanics*, 768: 415–441
<https://doi.org/10.1017/jfm.2015.85>
10. F. Gomez, H.M. Blackburn, M. Rudman, B.J. McKeon, **M. Luhar**, R. Moarref, and A.S. Sharma (2014) On the origin of frequency sparsity in direct numerical simulations of turbulent pipe flow, *Physics of Fluids*, 26, 101703
<https://doi.org/10.1063/1.4900768>
9. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2014) On the structure and origin of pressure fluctuations in wall turbulence: predictions based on the resolvent analysis, *Journal of Fluid Mechanics*, 751: 38–70
<https://doi.org/10.1017/jfm.2014.283>
8. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2014) Opposition control within the resolvent analysis framework, *Journal of Fluid Mechanics*, 749: 597–626
<https://doi.org/10.1017/jfm.2014.209>
7. **M. Luhar**, E. Infantes, A. Orfila, J. Terrados, and H.M. Nepf (2013) Field observations of wave-induced streaming through a submerged seagrass (*Posidonia oceanica*) meadow, *Journal of Geophysical Research - Oceans*, 118: 1955–1968
<https://doi.org/10.1002/jgrc.20162>
6. **M. Luhar** and H.M. Nepf (2013) From the blade scale to the reach scale: a characterization of aquatic vegetative drag, *Advances in Water Resources*, 51: 305–316
<https://doi.org/10.1016/j.advwatres.2012.02.002>
5. E. Infantes, A. Orfila, G. Simarro, J. Terrados, **M. Luhar**, and H.M. Nepf (2012) Effect of a seagrass (*Posidonia oceanica*) meadow on wave propagation, *Marine Ecology Progress Series*, 456: 63–72
<https://doi.org/10.3354/meps09754>
4. Marcos[†], J.R. Seymour[†], **M. Luhar**[†], W.M. Durham[†], J.G. Mitchell, A. Macke, and R. Stocker[†] (2011) Microbial alignment in flow changes ocean light climate, *Proceedings of the National Academy of Sciences USA*, 108(10): 3860 († authors contributed equally)
<https://doi.org/10.1073/pnas.1014576108>
3. **M. Luhar** and H.M. Nepf (2011) Flow-induced reconfiguration of buoyant and flexible aquatic vegetation, *Limnology and Oceanography*, 56(6): 2003–2017
<https://doi.org/10.4319/lo.2011.56.6.2003>
2. **M. Luhar**, S. Coutu, E. Infantes, S. Fox, and H.M. Nepf (2010) Wave-induced velocities inside a model seagrass bed, *Journal of Geophysical Research - Oceans*, 115, C12005
<https://doi.org/10.1029/2010JC006345>
1. **M. Luhar**, J. Rominger, and H.M. Nepf (2008) Interaction between flow, transport and vegetation spatial structure, *Environmental Fluid Mechanics*, 8(5): 423–439
<https://doi.org/10.1007/s10652-008-9080-9>

BOOK CHAPTERS

1. M. Hermes*, M. Ishida, **M. Luhar**, and M. Tolley (2021) Bioinspired shape-changing soft robots for underwater locomotion: actuation and optimization for crawling and swimming, In: Paley D.A., Wereley N.M. (eds) *Bioinspired Sensing, Actuation, and Control in Underwater Soft Robotic Systems*, Springer, Cham.
https://doi.org/10.1007/978-3-030-50476-2_2

CONFERENCE PAPERS WITH PRESENTATIONS (REFEREED)

11. C.V. Krishna*, M. Wang, M. Hemati, and **M. Luhar** (2019) Fusion of physics-based models with field measurements for turbulent flow reconstruction, Eleventh International Symposium of Turbulence and Shear Flow Phenomena (TSFP-11). [~ 50% acceptance rate]
10. A. Chavarin*, C. Efstathiou*, S. Vijay*, and **M. Luhar** (2019) Resolvent-based design and experimental testing of porous materials for passive turbulence control, Eleventh International Symposium of Turbulence and Shear Flow Phenomena (TSFP-11). [~ 50% acceptance rate]

9. D. W. MacPhee and **M. Luhar** (2018) Asymmetric buckling of curved flapping wings, *AIAA*, 2018-3079. [~ 80% acceptance rate]
8. Y. Li, P. Hu, H. Mao, M. Hermes*, L. Zhang, H. Lim, **M. Luhar**, J. Yoon, Y. Chen, and W. Wu (2017) Multi-Scale Manufacture for Bio-Inspired Structure Enabled by Variable Voxel Stereolithography, *IEEE-Nano*, 230-231. [~ 75% acceptance rate]
7. C. Efstathiou* and **M. Luhar** (2017) Turbulent boundary layer measurements over permeable surfaces, *Tenth International Symposium of Turbulence and Shear Flow Phenomena (TSFP-10)*. [~ 50% acceptance rate]
6. **M. Luhar** (2017) Low-order models for turbulent flows over complex walls, *Tenth International Symposium of Turbulence and Shear Flow Phenomena (TSFP-10)*. [~ 50% acceptance rate]
5. K. Rosenberg, S. Duvvuri, **M. Luhar**, B.J. McKeon, C. Barnard, B. Freidkes, J. Meloy, and M. Sheplak (2016) Phase relationships between velocity, wall pressure, and wall shear stress in a forced turbulent boundary layer, *46th AIAA Fluid Dynamics Conference*. [~ 80% acceptance rate]
4. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2015) On the design of optimal compliant walls for turbulence control, *Ninth International Symposium of Turbulence and Shear Flow Phenomena (TSFP-9)*. [~ 50% acceptance rate]
3. A. Sharma, R. Moarref, **M. Luhar**, D.B. Goldstein, and B.J. McKeon (2014) Effect of a gain-based optimal forcing on turbulent channel flow, *52nd Aerospace Sciences Meeting, AIAA*. [~ 80% acceptance rate]
2. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2013) A systems approach to modeling opposition control in turbulent pipe flow, *43rd Fluid Dynamics Conference, AIAA*. [~ 80% acceptance rate]
1. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2013) Wall pressure fluctuations induced by coherent structures in turbulent pipe flow, *Eighth International Symposium of Turbulence and Shear Flow Phenomena (TSFP-8)*. [~ 50% acceptance rate]

CONFERENCE PRESENTATIONS (ABSTRACT ONLY)

43. S. Vijay* and **M. Luhar** (2020) Interfacial thermal transport in partially porous channel flow at turbulent flow regimes, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 73rd Annual Meeting*.
42. M. Hermes* and **M. Luhar** (2020) Sea stars generate downforce to stay attached to surfaces, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 73rd Annual Meeting*.
41. A. Chavarin* and **M. Luhar** (2020) Model-based Predictions for Optimal Two-dimensional Riblets, *Invited AIAA-JSASS Joint Session on Boundary Layer Modification, AIAA SciTech, Orlando, FL*
40. A. Chavarin*, G. Gomez-de-Segura, R. Garcia-Mayoral, and **M. Luhar** (2019) Resolvent-informed design of anisotropic permeable substrates for turbulence control, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 72nd Annual Meeting, Seattle, WA*.
39. C. Efstathiou* and **M. Luhar** (2019) Measurements in turbulent boundary layers over designed anisotropic porous materials, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 72nd Annual Meeting, Seattle, WA*.
38. **M. Luhar** and A. Chavarin* (2019) A minimal model for riblet geometry optimization, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 72nd Annual Meeting, Seattle, WA*.
37. M. Wang, C.V. Krishna*, **M. Luhar**, and M. Hemati (2019) Multi-Rate and Multi-Fidelity Sensor Fusion for Wall-Bounded Turbulent Flow Reconstruction, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 72nd Annual Meeting, Seattle, WA*.
36. S. Vijay* and **M. Luhar** (2019) Experimental evaluation of thermal transport in partially-porous channel flow, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 72nd Annual Meeting, Seattle, WA*.
35. C.V. Krishna*, M. Wang, M. Hemati, and **M. Luhar** (2019) Resolvent-mode-based Reconstruction of Wall-bounded Turbulent Flows From Non-time resolved PIV Measurements, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 72nd Annual Meeting, Seattle, WA*.

34. C.V. Krishna*, M. Wang, M. Hemati, and **M. Luhar** (2018) Model-based fusion of PIV and hot-wire measurements for reconstruction of wall-bounded turbulent flows, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 71st Annual Meeting, Atlanta, GA*
33. C. Efstathiou*, A. Todt*, and **M. Luhar** (2018) A novel method to measure 3D permeability of highly porous materials, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 71st Annual Meeting, Atlanta, GA*
32. S. Vijay* and **M. Luhar** (2018) Convective heat transfer in partially-porous channel flow, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 71st Annual Meeting, Atlanta, GA*
31. M. Wang, C.V. Krishna*, **M. Luhar** and M. Hemati (2018) Physics-based multi-sensor fusion for statistically optimal reconstruction of wall-bounded turbulence, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 71st Annual Meeting, Atlanta, GA*
30. M. Hermes* and **M. Luhar** (2018) Hydrodynamic effects of sea star morphology and orientation to flow, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 71st Annual Meeting, Atlanta, GA*
29. A. Chavarin* and **M. Luhar** (2018) Optimization of two-dimensional riblet geometries using resolvent analysis, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 71st Annual Meeting, Atlanta, GA*
28. **M. Luhar** (2017) Modeling coherent structures in canopy flows, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 70th Annual Meeting, Denver, CO*
27. C. Efstathiou* and **M. Luhar** (2017) Turbulent boundary layer measurements over permeable substrates, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 70th Annual Meeting, Denver, CO*
26. A. Kawagoe, S. Nakashima, **M. Luhar**, and K. Fukagata (2017) Resolvent-based feedback control for turbulent friction drag reduction, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 70th Annual Meeting, Denver, CO*
25. S. Nakashima, K. Fukagata and **M. Luhar** (2017) Resolvent analysis of suboptimal control for turbulent skin friction drag reduction, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 70th Annual Meeting, Denver, CO*
24. S. Toedtli, **M. Luhar** and B. McKeon (2017) Comparison between DNS data and resolvent model prediction of opposition control with a phase shift between sensor and actuator, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 70th Annual Meeting, Denver, CO*
23. A. Kawagoe, S. Nakashima, **M. Luhar**, and K. Fukagata (2017) Turbulent friction drag reduction based on resolvent analysis, *Ninth JSME-KSME Thermal and Fluids Engineering Conference (TFEC9), Okinawa, Japan*
22. S. Nakashima, **M. Luhar**, and K. Fukagata (2017) Resolvent analysis of spanwise rotating turbulent channel flow, *16th European Turbulence Conference (ETC16), Stockholm, Sweden*
21. A. Kawagoe, S. Nakashima, **M. Luhar**, and K. Fukagata (2017) Proposal of control laws for turbulent friction drag reduction based on resolvent analysis, *16th European Turbulence Conference (ETC16), Stockholm, Sweden*
20. S. Nakashima, K. Fukagata and **M. Luhar** (2016) Assessment of suboptimal control effect for turbulent friction drag reduction using resolvent mode analysis, *11th European Fluid Mechanics Conference (EFMC11), Seville, Spain*
19. C. Efstathiou* and **M. Luhar** (2016) Turbulent boundary layer measurements over high-porosity surfaces, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 69th Annual Meeting, Portland, OR*
18. C. Ohh*, Y. Huang, Z. Wen*, E. Kanso, and **M. Luhar** (2016) Leveraging fluid-structure interaction for passive control of flapping locomotion, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 69th Annual Meeting, Portland, OR*
17. **M. Luhar** (2016) Energy amplification in turbulent flows over complex walls, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 69th Annual Meeting, Portland, OR*
16. S. Nakashima, K. Fukagata, and **M. Luhar** (2016) Assessment of suboptimal control effect for turbulent friction drag reduction using resolvent mode analysis, *11th European Fluid Mechanics Conference, Seville, Spain*

15. K. Rosenberg, S. Duvvuri, **M. Luhar**, B.J. McKeon, C. Barnard, B. Freidkes, J. Meloy, and M. Sheplak (2016) Phase relationships between velocity, wall pressure, and wall shear stress in a forced turbulent boundary layer, *46th AIAA Fluid Dynamics Conference, Washington, D.C.*
14. **M. Luhar** and H. Nepf (2015) On the dynamics of flexible blades in oscillatory flow, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 68th Annual Meeting, Boston, MA*
13. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2015) On the design of optimal compliant walls for turbulence control, *Ninth International Symposium of Turbulence and Shear Flow Phenomena (TSFP-9), Melbourne, Australia*
12. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2014) A framework for studying the effect of compliant surfaces on wall turbulence, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 67th Annual Meeting, San Francisco, CA*
11. F. Gomez, H.M. Blackburn, M. Rudman, B.J. McKeon, **M. Luhar**, R. Moarref, A.S. Sharma (2014) Sparse energetically dominant frequencies in direct numerical simulation of turbulent pipe flow: origin and application to reduced-order models, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 67th Annual Meeting, San Francisco, CA*
10. A. Sharma, R. Moarref, **M. Luhar**, D.B. Goldstein, and B.J. McKeon (2014) Effect of a gain-based optimal forcing on turbulent channel flow, *52nd Aerospace Sciences Meeting, AIAA, National Harbor, MD*
9. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2014) Resolvent-based predictions for the pressure field induced by turbulent flows, *17th US National Conference on Theoretical and Applied Mechanics, Michigan State University, Lansing, MI*
8. A. Sharma, R. Moarref, **M. Luhar**, D. Goldstein, and B.J. McKeon, (2013) An investigation of the flow modification in a turbulent channel with gain-based optimal forcing, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 66th Annual Meeting, Pittsburgh, PA*
7. **M. Luhar**, A.S. Sharma, and B.J. McKeon, (2013) Deconstructing the effectiveness of opposition control in turbulent pipe flow, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 66th Annual Meeting, Pittsburgh, PA*
6. S. Duvvuri, **M. Luhar**, C. Barnard, M. Sheplak, and B.J. McKeon (2013) A study of synthetic large scales in turbulent boundary layers, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 66th Annual Meeting, Pittsburgh, PA*
5. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2013) A systems approach to modeling opposition control in turbulent pipe flow, *43rd Fluid Dynamics Conference, AIAA, San Diego, CA*
4. **M. Luhar**, A.S. Sharma, and B.J. McKeon (2013) Wall pressure fluctuations induced by coherent structures in turbulent pipe flow, *Eighth International Symposium of Turbulence and Shear Flow Phenomena (TSFP-8), Poitiers, France*
3. **M. Luhar** and H. Nepf (2012) Wave-induced dynamics of flexible aquatic vegetation, *Fluid and Elasticity 2012, La Jolla, CA*
2. **M. Luhar** and H. Nepf (2011) Aquatic vegetation: to buoy or not to buoy, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 64th Annual Meeting, Baltimore, MD*
1. **M. Luhar**, Z. Zhang, and R. Stocker (2009) Motility-enhanced biofloculation, *American Physical Society–Division of Fluid Dynamics (APS-DFD), 62nd Annual Meeting, Minneapolis, MN*

SELECTED INVITED TALKS

23. Tunable Porous and Patterned Surfaces for Turbulence Control, Aerospace and Mechanical Engineering Seminar, University of Southern California [2020-10-21]
22. Flow through regions with aquatic vegetation, Institute of Marine Science Seminar, University of North Carolina (remote) [2020-09-17]
21. Model-based Predictions for Optimal Two-dimensional Riblets, *Invited AIAA-JSASS Joint Session on Boundary Layer Modification, AIAA SciTech, Orlando, FL* [2020-01-07]

20. Model-based design of active and passive flow control for wall turbulence, Mechanical Engineering Seminar, University of California – Santa Barbara, Santa Barbara, CA [2019-12-04]
19. Model-based design of active and passive flow control for wall turbulence, Aerospace Engineering and Mechanics Seminar, University of Minnesota, Twin Cities, MN [2019-11-08]
18. Model-based design of active and passive flow control for wall turbulence, Joint CSC/CommNetS-MHI Seminar Series, University of Southern California, Los Angeles, CA [2019-09-23]
17. Optimization of Riblet Geometry Using Low-Order Models, *Invited Special Session: Reduced-Complexity Modeling for Flow Control*, AIAA Aviation, Dallas, TX [2019-06-18]
16. Model-based design of active and passive flow control for wall turbulence, Mechanical and Aerospace Engineering Seminar, University of California – Irvine, Irvine, CA [2018-11-30]
15. Model-based design of active and passive flow control for wall turbulence, FlowPAC Seminar, University of Notre Dame, South Bend, IN [2018-11-01]
14. Model-based design of active and passive flow control for wall turbulence, Linne Flow Centre Seminar, Royal Institute of Technology (KTH), Stockholm, Sweden [2018-09-06]
13. Resolvent analysis for turbulent flow over patterned walls , *Invited Special Session: Modal Decomposition Techniques*, AIAA Aviation, Atlanta, GA [2018-06-25]
12. Asymmetric buckling of curved flapping wings, *Invited Special Session: Flow-induced Flutter*, AIAA Aviation, Atlanta, GA [2018-06-25]
11. Resolvent analysis, *Invited Special Session: Modal Decomposition Techniques*, AIAA Aviation, Washington, D.C. [2016-06-14]
<https://youtu.be/yLj0WyHM8hM>
10. Flow through regions with aquatic vegetation, Environmental Fluid Mechanics Seminar, Cornell University, Ithaca, NY [2015-04-23]
9. A framework for studying the effect of compliant surfaces on wall turbulence, Fluid Mechanics and Combustion Seminar, University of California San Diego, San Diego, CA [2015-03-09]
8. Flow through regions with aquatic vegetation, Naval Architecture and Ocean Engineering Seminar, United States Naval Academy, Annapolis, MD [2014-03-06]
7. Flow through regions with aquatic vegetation, Civil and Environmental Engineering Seminar, Duke University, Durham, NC [2014-02-20]
6. Understanding and controlling wall-bounded turbulent flows, Aerospace and Mechanical Engineering Seminar, USC, Los Angeles, CA [2014-02-10]
5. Flow through regions with aquatic vegetation, Civil and Environmental Engineering Seminar, North Carolina State University, Raleigh, NC [2014-01-23]
4. Flow through regions with aquatic vegetation, Water Resources Engineering Seminar, Virginia Tech, Blacksburg, VA [2014-01-15]
3. Characterizing vegetation drag in aquatic systems, Environmental Sciences Graduate Program Seminar, Ohio State University, Columbus, OH [2013-11-19]
2. Vegetated hydrodynamics: from the blade-scale to the canopy-scale, Environmental Science and Engineering Special Seminar, Harvard University, Cambridge, MA [2012-05-02]
1. Vegetated hydrodynamics: from the blade-scale to the canopy-scale, Invited Seminar, Colorado State University, Fort Collins, CO [2012-03-01]

EXTERNAL RESEARCH GRANTS

Total: \$3,136,451
As PI: \$1,137,804
Luhar Portion: \$1,462,934

CAREER: Flow Control with Cellular Materials

Agency NSF (CAREER Program)
Duration 01/2020 - 12/2024
PI M. Luhar
Amount \$500,000

This project aims to design and fabricate cellular materials for the control of turbulent flows, and to test these materials in laboratory water channel experiments.

Designer Porous Materials for Flow Control: Effective Property Characterization

Agency AFOSR
Duration 08/2019 - 07/2022
PI M. Luhar
Co-PI S. Bagheri (KTH, Sweden)
Amount 188,732 (PI Luhar Portion: \$113,862)

This project will develop a framework that combines numerical simulations with laboratory experiments to characterize the *bulk* flow resistance of porous materials as a function of their pore structure. PI Luhar is responsible for the experimental component of the research and project coordination.

StarBot: Biological inspiration for crawling and manipulation under hydrodynamic loads

Agency ONR (Basic Research Challenge)
Duration 01/2017 - 12/2021
PI E. Kanso (USC)
Co-PIs M. Luhar, M. Tolley (UC San Diego), S. Cai (UC San Diego), M. McHenry (UC Irvine)
Amount \$1,998,647 (Co-PI Luhar Portion: \$400,000)

This collaborative project seeks to develop echinoderm-inspired soft robots capable of functioning in challenging underwater environments. PI Luhar is responsible for hydrodynamic modeling, optimization, and laboratory testing of the robots being developed.

Tunable Porous and Patterned Surfaces for Turbulence Control

Agency AFOSR (Young Investigator Program)
Duration 02/2017 - 08/2021
PI M. Luhar
Amount \$449,072

This project aims to develop and test a reduced-complexity modeling framework that can be used to design and optimize functional surfaces (e.g., riblets) for turbulence control.

INTERNAL GRANTS

USC Center for Sustainability Solutions

PI D. Sung
Duration 08/2020 - 08/2021
Co-PIs I. Bermejo-Moreno (AME), M. Luhar (AME), G. Ban-Weiss (CEE), V. San Fratello (San Jose State), S. Adriaenssens (Princeton), R. Fortmeyer (ARUP), E. Avol (USC Keck), D. Sloane (USC Price)
Amount \$150,000

USC Undergraduate Research Associates Program

PI M. Luhar
Duration 05/2020 - 08/2020
Co-PIs I. Bermejo-Moreno (AME), D. Sung (Architecture)
Amount \$6600

USC Undergraduate Research Associates Program

PI M. Luhar
Duration 08/2016 - 05/2017
Amount \$6400

USC Undergraduate Research Associates Program

PI M. Luhar
Duration 08/2015 - 05/2016
Amount \$3200

TEACHING**USC**

| | |
|---|-----------------|
| | Los Angeles, CA |
| AME 530a Dynamics of Incompressible Flow (<i>student rating: 4.8/5.0</i>) | Fall 2015 |
| AME 530b Dynamics of Incompressible Flow (<i>student rating: 4.5/5.0</i>) | Spring 2016 |
| AME 530b Dynamics of Incompressible Flow (<i>student rating: 5.0/5.0</i>) | Spring 2017 |
| AME 530a Dynamics of Incompressible Flow (<i>student rating: 4.8/5.0</i>) | Fall 2017 |
| AME 530b Dynamics of Incompressible Flow (<i>student rating: 4.9/5.0</i>) | Spring 2018 |
| AME 530a Dynamics of Incompressible Flow (<i>student rating: 4.8/5.0</i>) | Fall 2018 |
| AME 309 Dynamics of Fluids (<i>student rating: 4.9/5.0</i>) | Spring 2019 |
| AME 309 Dynamics of Fluids (<i>student rating: 4.8/5.0</i>) | Spring 2020 |

Caltech

| | |
|---|---------------------------|
| Guest Lecturer and Lab Instructor, Experimental Methods | Pasadena, CA 2012-2013 |
|---|---------------------------|

MIT

| | |
|---|-----------------------|
| Teaching Assistant, Transport Processes in the Environment (<i>student rating: 6.7/7.0</i>) | Cambridge, MA 2011 |
| Instructor, Traveling Research Environmental Experiences | 2011 |
| Lab Instructor, Environmental Fluid Transport Processes (<i>student rating: 7.0/7.0</i>) | 2010-2011 |

RESEARCH MENTORING**Doctoral**

| Name | Role | Dates | Placement |
|----------------------|-------------------------|-----------------|-------------------------|
| Morgan Jones | Co-Advisor [†] | 08/2020-present | |
| Sultan Aljnadi | Co-Advisor* | 08/2019-present | |
| C. Vamsi Krishna | Advisor | 08/2017-present | |
| Shilpa Vijay | Advisor | 08/2016-present | |
| Mark Hermes | Advisor | 08/2016-present | |
| Andrew Chavarin | Advisor | 08/2016-10/2020 | Postdoc at USC |
| Christoph Efstathiou | Advisor | 08/2015-06/2020 | Postdoc at UC San Diego |

[†] With Dr. E. Kanso (AME)

* With Dr. A. Childress (CEE)

Doctoral Dissertation Committees

| Name | Department | Dates |
|--------------------|------------|-------|
| Wei Ran | AME | 2020 |
| Vassilios Skanavis | CEE | 2020 |

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| | | |
|----------------------|-----|------|
| Joel Bahena | AME | 2020 |
| Chelsea Appleget | AME | 2020 |
| Christoph Efstathiou | AME | 2020 |
| Adam Keen | CEE | 2020 |
| Longlong Chang | AME | 2019 |
| Pradeep Rajendran | AME | 2019 |
| Luis Montoya | CEE | 2019 |
| Joseph Tank | AME | 2018 |
| Try Lam | AME | 2018 |
| Brendan Colvert | AME | 2018 |
| Tongtong Guo | AME | 2017 |
| Xinjiang Xiang | AME | 2017 |
| Stylios Koumlis | AME | 2017 |
| Hanliang Guo | AME | 2016 |
| Dong-Joon Lee | AME | 2016 |
| Haeng Sik Ko | CEE | 2016 |

Doctoral Qualifying Exam Committees

My qualifying exam committee assignments involve significant overlap with the dissertation committee assignments above, include 4 of my Ph.D. students, and additional AME students. A full list is available upon request.

Masters

| Name | Role | Dates | Placement |
|-----------------------------|-------------|-----------|---------------------------|
| Yiyu Chen | Co-Advisor* | 2020 | |
| Chiao-Chih Hsu | Co-Advisor* | 2020 | |
| Rushabh Rupani [†] | Advisor | 2020 | |
| Haotian Ma [†] | Co-Advisor* | 2019-2020 | |
| Siyang Hao [†] | Co-Advisor* | 2019-2020 | Ph.D. at Brown University |
| Kamran Akhtar | Advisor | 2017-2018 | |
| Yixuan Song | Advisor | 2017-2018 | Ph.D. at U Penn |
| William Rose | Advisor | 2017 | GE Aviation |
| Changning Zhou | Advisor | 2016-2017 | Google |
| Shen Wang | Advisor | 2016-2017 | |
| Hyunggon Park | Advisor | 2016-2017 | Ph.D. at VirginiaTech |
| Ziteng Wen | Advisor | 2015-2017 | Ph.D. at UMD |
| Chan-Ye Ohh [†] | Advisor | 2015-2017 | Ph.D. at USC |
| Anup Kanale | Advisor | 2015-2016 | Ph.D. at USC |
| Han Tu | Advisor | 2015-2016 | Ph.D. at Syracuse U |

* *With Dr. SK Gupta (AME)*

[†] *Directed Research*

Undergraduate

| Name | Department | Dates |
|---------------------------------|------------|--------------|
| Akansha Singh ⁺ | AME | 2020-present |
| Bryce Heitner ⁺ | AME | 2020-present |
| Ashwini Balaganesh ⁺ | AME | 2020 |
| Mohamed Tijani [†] | AME | 2020 |
| Stara Shinsato | AME | 2019-present |
| Jefferson Nguyen* | AME | 2019-present |
| Michelle Karpishin ⁺ | AME | 2019-2020 |
| Zachary Begland* | AME | 2019-2020 |
| Moheb Salmoun [†] | AME | 2019-2020 |
| Eshaan Agadi [†] | AME | 2019 |

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| | | |
|-----------------------------|------|-----------|
| Taofeeq Rasaki | AME | 2019 |
| Anika Todt ^{*,◦} | CEMS | 2018-2020 |
| Caitlin Buckley | AME | 2018-2020 |
| Alyssa Ishigo | AME | 2018-2020 |
| Julia Wang [◦] | AME | 2017-2019 |
| Albert Kong | AME | 2016-2019 |
| Nina Singh ^{*,◦,‡} | BME | 2016-2019 |
| Alon Tivon | AME | 2016-2017 |
| Jane Hong | AME | 2016-2017 |
| Sifat Syed [‡] | AME | 2015-2017 |
| Allison Miranda | AME | 2015-2016 |
| Brian Loh | AME | 2015-2016 |
| Dennis Tran | AME | 2015-2016 |

* *Recipient of USC Provost Fellowship*

◦ *Recipient of USC WiSE Fellowship*

+ *Viterbi Research Fellow*

‡ *USC URAP Support*

† *Directed Research*

High-School

| Name | Program | Dates |
|------------------|-------------------|-------|
| Asa Garner | USC SHINE Program | 2020 |
| Madeleine Yee | USC SHINE Program | 2020 |
| Noah Shen | USC SHINE Program | 2019 |
| Jacklyn Oldoerp | USC SHINE Program | 2019 |
| Brody Bishop | USC SHINE Program | 2018 |
| Sarah Fry | USC SHINE Program | 2018 |
| Timothy Kim | USC SHINE Program | 2017 |
| Alejandro Avilez | USC SHINE Program | 2017 |
| Erik Szayna | USC SHINE Program | 2016 |
| Akash Velu | USC SHINE Program | 2016 |

THESES SUPERVISED

Ph.D.

Christoph Efstathiou 2020

Development of Tuned Anisotropic Porous Materials for Turbulence Control

Andrew Chavarin 2020

Model based design of porous and patterned surfaces for passive turbulence control

M.S.

Chan-Ye Ohh 2017

Passive Rolling and Flapping Dynamics of a Heaving Λ flyer

INTERNAL SERVICE

Departmental Committees and Service

AME Industry Day Organizing Committee 2018

Search Committee for Department Chair 2017

STEM Spotlight on AME Participant 2017

AME Seminar Organizer 2017-2019

Explore USC Days Host (≥ 1 in each year) 2017-present

Ph.D. Admissions Committee 2016-present

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|---|--------------|
| Ph.D. Screening Exam Committee (Fluid Dynamics) | 2016-present |
| AME 441 Project Mentor (≥ 2 in each year) | 2016-present |

School and University Service

| | |
|--|--------------|
| Goldwater Scholarship Campus Selection Committee | 2021 |
| USC Viterbi Engineering Honors Colloquium | 2020 |
| USC Viterbi vs. Pandemics Lecture Series | 2020 |
| USC Center for Excellence in Research NSF Career Panel | 2020 |
| Goldwater Scholarship Campus Selection Committee | 2020 |
| Viterbi/Dornsife Machine Shop Faculty Advisory Committee | 2020-present |
| USC Society for Hispanic Professional Engineers Research Networking Events | 2019-present |
| Goldwater Scholarship Campus Selection Committee | 2019 |
| Astronaut Scholarship Campus Selection Committee | 2019 |
| USC Center for Engineering Diversity Spring Faculty Series | 2018-present |
| USC Viterbi Robotics Open House Participant | 2017–2019 |

EXTERNAL SERVICE

Board and Committee Memberships

| | |
|--|--------------|
| <i>13th European Fluid Mechanics Conference, Zurich, Switzerland</i> | 2020 |
| Mini-symposium on Flows over complex surfaces, canopies and porous boundaries (<i>deferred to 2021</i>) <i>Co-organizers</i> S. Bagheri (KTH, Sweden) and M. Luhar | |
| <i>Turbulence and Shear Flow Phenomena (TSFP) Conference</i> Member of Advisory Committee | 2019-present |
| <i>72nd APS-DFD Annual Meeting, Seattle, WA</i> Poster Competition Judging Committee | 2019 |
| <i>12th Southern California Flow Physics Symposium, USC, Los Angeles, CA</i> <i>Co-organizers</i> I. Bermejo-Moreno, M. Luhar and G. Spedding (USC) | 2018 |
| <i>70th APS-DFD Annual Meeting, Denver, CO</i> Mini-symposium and Focus Sessions on Modal Analysis Methods for Fluid Flows <i>Co-organizers</i> M. Luhar , M. Hemati (UMN) and K. Taira (FSU) | 2017 |
| <i>American Institute of Aeronautics and Astronautics (AIAA)</i> Member of Discussion Group on Reduced-Complexity Flow Modeling and Analysis | 2016-present |
| <i>American Physical Society–Division of Fluid Dynamics</i> Member of Committee on Educational and Career Outreach | 2016–2017 |
| <i>STEM Academy of Hollywood</i> Member of Advisory Board | 2015-present |
| <i>Caltech Postdoctoral Association</i> Association Chair | 2013–2014 |

Session Chair

| | |
|--|------|
| 72nd APS-DFD Annual Meeting, Seattle, WA | 2019 |
| 70th APS-DFD Annual Meeting, Denver, CO | 2017 |
| 69th APS-DFD Annual Meeting, Portland, OR | 2016 |
| 68th APS-DFD Annual Meeting (Focus Session: Reconfiguration), Boston, MA | 2015 |
| 9th Southern California Flow Physics Symposium, San Diego, CA | 2015 |
| 66th APS-DFD Annual Meeting, Pittsburgh, PA | 2013 |
| 43rd AIAA Fluid Sciences Event, San Diego, CA | 2013 |

Referee

Reviewer for over 25 journals and funding bodies, including:

Journal of Fluid Mechanics, Experiments in Fluids, Physical Review Fluids, Nature Communications, Nature Physics, Nature Geoscience, Proceedings of the Royal Society of London A, Journal of Geophysical Research, Limnology and Oceanography, Experimental Thermal and Fluid Science, AIAA Journal, International Journal for Heat and Fluid Flow, Current Biology, Air Force Office of Scientific Research, Army Research Office, National Science Foundation, Israel Science Foundation, Maryland Sea Grant

Professional Memberships

American Physical Society - Division of Fluid Dynamics, American Geophysical Union, American Institute of Aeronautics and Astronautics, American Society of Limnology and Oceanography

Other

Developed publicly available Resolvent Analysis code for pipe and channel flows:

<http://www.github.com/mluhar/resolvent>

Developed publicly available code to simulate wave-induced dynamics of flexible blades:

<http://www.github.com/mluhar/dynamicblade>