Muralikrishnan Gopalakrishnan Meena

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CURRENT AFFILIATION

Computational Scientist, R&D Staff
Oak Ridge Leadership Computing Facility
Oak Ridge National Laboratory, Tennessee, USA

EDUCATION

University of California, Los Angeles, USA *January 2019 - June 2020*
Ph.D., Mechanical Engineering, minor in Applied Mathematics
Dissertation: Network community-based analysis of complex vortical flows: Laminar & turbulent flows
Advisor: Prof. Kunihiko Taira

Florida State University, USA *August 2015 - December 2018*
Master of Science, Mechanical Engineering

Cochin University of Science & Technology, India *June 2010 - May 2014*
Bachelor of Technology, Mechanical Engineering

RESEARCH AREAS OF INTEREST

Advanced Scientific Computing & Data Science: • Machine learning (clustering/segmentation, regression, classification, interpretability, distributed training) • Quantum computing (linear solvers, tensor networks) • Network science (graph theory) • Reduced-order modeling

Physical & Biological Sciences: • Fundamental turbulence • Atmospheric & oceanographic turbulence • Vortex interaction • Unsteady aerodynamics • Fungal community interactions & metabolic networks • Biomedical image segmentation

TECHNICAL SKILLS

Scientific Computing:

- *Quantum computing*: Research areas - quantum linear solver, variational quantum linear solver, noise modeling and mitigation, tensor networks; SDKs - IBM Qiskit (IBM Provider, Runtime Primitives, Session), PennyLane, pyTKET, ITensor; Running on hardware (IBM Quantum Computing, IonQ, Quantinuum, IQM)
- *Machine learning & Data Science*: Packages - PyTorch (Python & C++ API, with multi-node GPU distributed data-parallel training & inference), TensorFlow (Keras), Scikit-learn, NetworkX, Matlab BCT for graphs; ML Models - mainly using MLP, ResNet, CNN, RNN, LSTM, Neural ODE, Transformer (Vision Transformer)
- *Parallel computation & HPC*: MPI, bash scripting, HPCToolkit for profiling (basic user), various HPC systems of US-DOE (OLCF: Frontier, Summit, Andes; NERSC: Perlmutter), US-DOD (Gordon & Conrad), and academia (UCLA & FSU)
- *CFD solvers*: DNS & LES solvers (based on immersed boundary method, finite difference & volume, spectral) in HPC environment
- *Performance portability*: Basic user of YAKL & HIP (including ROCm profiler & debugger)
- *Distributed version-control*: Git, Github, GitLab
- *Visualization*: Python, Draw.io, MayaVi, Ncview, Matlab, Tecplot, ParaView, OmniGraffle

Programming Languages:

- Python (including Jupyter Lab), C++ (basic user of `gdb` & `valgrind` debuggers), Fortran, Julia, Matlab

Last updated: February 8, 2025

WORK EXPERIENCE

Oak Ridge National Laboratory *July 2020 - Present*
Computational Scientist, R&D Staff (October 2024 - present)
Computational Scientist, R&D Associate (March 2022 - September 2024)
Postdoctoral Research Associate (July 2020 - February 2022)

Indian Institute of Technology Madras, India *December 2023*
Honorary Visiting Faculty Fellow

University of California, Los Angeles *January 2019 - June 2020*
Graduate Research Assistant

Florida State University *August 2015 - December 2018*
Graduate Research Assistant
Teaching Assistant: Numerical Methods for Engineers (Spring 2016, 2017)

PUBLICATION

Google Scholar: scholar.google.com/citations?user=2yNLfcsAAAAJ&hl=en

Peer-reviewed Journal Articles

1. A. Sahay, **M. Gopalakrishnan Meena**, and R. I. Sujith "Insights into the interplay between hydrodynamic and acoustic fields in a turbulent combustor via community-based dimensionality reduction of vortical networks," *in-review*, 2025 (preprint)
2. **M. Gopalakrishnan Meena**, D. Liousas, A. D. Simin, A. Kashi, W. H. Brewer, J. J. Riley, S. M. de Bruyn Kops, "Machine-learned closure of URANS for stably stratified turbulence: connecting physical timescales & data hyperparameters of deep time-series models," Machine Learning: Science and Technology, 5 (4), 045063, 2024 (link, code)
3. **M. Gopalakrishnan Meena**, K. Gottiparthi, J. Lietz, A. Georgiadou, and E. A. Coello Pérez, "Solving the Hele–Shaw flow using the Harrow–Hassidim–Lloyd algorithm on superconducting devices: A study of efficiency and challenges," Physics of Fluids, 36 (10): 101705, 2024 (***Featured Article***) (link, preprint, code)
4. **M. Gopalakrishnan Meena**, M. R. Norman, D. M. Hall, and M. S. Pritchard, "Spatially local surrogate modeling of subgrid-scale effects in idealized atmospheric flows: A deep learned approach using high-resolution simulation data," Artificial Intelligence for the Earth Systems, 3, e230043, 2024 (link, code, data)
5. T. Beck et al., "Integrating Quantum Computing Resources into Scientific HPC Ecosystems," Future Generation Computer Systems, 161, 11-25, 2024 (***Editor's Choice Paper***) (link)
6. **M. Gopalakrishnan Meena**, M. J. Lane, J. Tannous, A. A. Carrell, P. E. Abraham, R. J. Giannone, J-M Ané, N. P. Keller, J. L. Labbé, D. Kainer, D. A. Jacobson, and T. A. Rush, "A glimpse into the fungal metabolomic abyss: Novel network analysis reveals relationships between exogenous compounds and their outputs", PNAS Nexus, Volume 2, Issue 10, pgad322, 2023 (link, code)
7. M. R. Norman, C. Eldred, and **M. Gopalakrishnan Meena**, "Investigating inherent numerical stabilization for the moist, compressible, non-hydrostatic Euler equations on collocated grids", Journal of Advances in Modeling Earth Systems, 15, e2023MS003732, 2023 (link, code)
8. T.A. Rush, J. Tannous, M.J. Lane, **M. Gopalakrishnan Meena**, A. Carrell, J.J. Golan, M. T. Drott, S. Cottaz, S. Fort, J.M. Ané, N.P. Keller, D. A. Pelletier, D.A. Jacobson, D. Kainer, P. Abraham, R.J. Giannone, J.L. Labbé, "Lipo-chitooligosaccharides induce specialized fungal metabolite profiles that modulate bacterial growth", mSystems, 7 (6), e01052-22, 2022 (link)
9. T. A. Rush, H. K. Shrestha, **M. Gopalakrishnan Meena**, M. K. Spangler, J. C. Ellis, J. L. Labbé, and P. Abraham, "Bioprospecting Trichoderma: A systematic roadmap to screen genomes and natural products for biocontrol applications", Frontiers in Fungal Biology, 2:716511, 2021 (link)
10. S. Mahajan, L. S. Passarella, F. M. Hoffman, **M. Gopalakrishnan Meena**, and M. Xu, "Assessing teleconnections-induced predictability of regional water cycle on seasonal to decadal timescales using machine learning approaches", DOE BER AI4ESP, No. AI4ESP1086, 2021 (link)

11. **M. Gopalakrishnan Meena** and K. Taira, "Identifying vortical network connectors for turbulent flow modification", Journal of Fluid Mechanics, 915, A10, 2021 (link)
12. C.-A. Yeh, **M. Gopalakrishnan Meena**, and K. Taira, "Network broadcast analysis and control of turbulent flows", Journal of Fluid Mechanics, 910, A15, 2021 (link)
13. Z. Bai, N. B. Erichson, **M. Gopalakrishnan Meena**, K. Taira, and S. L. Brunton, "Randomized methods to characterize large-scale vortical flow network", PLOS One, 14(11), e0225265, 2019 (link)
14. **M. Gopalakrishnan Meena**, A. G. Nair, and K. Taira, "Network community-based model reduction for vortical flows", Physical Review E, 97, 063103, 2018 (link, code)
15. **M. Gopalakrishnan Meena**, K. Taira, and K. Asai, "Airfoil wake modification with Gurney flap at low-Reynolds number", AIAA Journal, 56(4), 1348-1359, 2018 (link)

Peer-reviewed Conference Proceedings

1. **M. Gopalakrishnan Meena**, Y. Zhang, W. Jiang, Y. Lin, S. Guenther, and X. Gao, "Towards a Quantum Algorithm for the Incompressible Nonlinear Navier–Stokes Equations", 2024 IEEE International Conference on Quantum Computing and Engineering (QCE), Montréal, Canada, September 14-21, pp. 662-668, 2024 (link)
2. A. Kashi, A. Daw, **M. Gopalakrishnan Meena**, H. Lu, "Learning the boundary-to-domain mapping using Lifting Product Fourier Neural Operators for partial differential equations," 2024 International Conference on Machine Learning (ICML) AI for Science Workshop, Vienna, Austria, July 21-27, 2024. (link)
3. D. Liousas, A. D. Simin, W. H. Brewer, A. Kashi, S. M. de Bruyn Kops, and **M. Gopalakrishnan Meena**, "Predicting Timescales in Dynamical Systems With Explainable Machine Learning Models," In XAI4Sci (Explainable machine learning for sciences) Workshop Proceedings, 38th Annual AAAI Conference on Artificial Intelligence, Vancouver, Canada, February 20-27, 2024 (link)
4. I. Lyngaas, **M. Gopalakrishnan Meena**, E. Calabrese, M. Wahib, P. Chen, J. Igarashi, Y. Huo and X. Wang, "Efficient Distributed Sequence Parallelism for Transformer-based Image Segmentation," High Performance Computing for Imaging Conference at Electronic Imaging Symposium, San Francisco, CA, January 21-25, 2024 (link)
5. W. Brewer, D. Martinez, **M. Gopalakrishnan Meena**, K. Borowiec, A. Kashi, S. Liu, C. Pilmaier, G. Burgreen, and S. Bhushan, "Entropy-Driven Optimal Sub-Sampling of Fluid Dynamics for Developing Machine-Learned Surrogates," 4th Workshop on Artificial Intelligence and Machine Learning for Scientific Applications, Proceedings of the SC'23 Workshops of The International Conference on High Performance Computing, Network, Storage, and Analysis, Pages 73–80, November, 2023 (link)
6. **M. Gopalakrishnan Meena**, A. K. Ziabari, S. V. Venkatakrishnan, I. R. Lyngaas, M. R. Norman, B. Joo, T. L. Beck, C. A. Bouman, A. J. Kapadia, and X. Wang, "Physics guided machine learning for multi-material decomposition of tissues from dual-energy CT scans of simulated breast models with calcifications," High Performance Computing for Imaging Conference at Electronic Imaging Symposium, San Francisco, CA, January 15-19, 2023 (***Conference Best Paper Award*** *and* ***Symposium Highlights Session***) (link)
7. N. L. Hickmon, et al., "Artificial Intelligence for Earth System Predictability (AI4ESP) Workshop Report (Section: Knowledge Discovery and Statistical Learning)", No. ANL-22/54. Argonne National Laboratory, Argonne, IL (United States), 2022. (link)
8. **M. Gopalakrishnan Meena**, M. R. Norman, and D. M. Hall, "Subgrid-scale surrogate modeling of idealized atmospheric flows: A deep learned approach using high-resolution simulation data," 12th International Symposium on Turbulence and Shear Flow Phenomena, Osaka, Japan, July 19 - 22 (Online), 2022 (TSFP 12 229) (link)
9. M. R. Norman and **M. Gopalakrishnan Meena**, "Confident, adaptable, and robust machine learning to augment traditional modeling and simulation," Position Papers for the ASCR Workshop on Reimagining Codesign, USDOE Office of Science (United States), 2021 (link)
10. **M. Gopalakrishnan Meena** and K. Taira, "Characterizing influential networked structures in isotropic turbulence," 11th International Symposium on Turbulence and Shear Flow Phenomena, Southampton, UK, July 30 - Aug. 2, 2019 (TSFP 11 235) (link)

11. **M. Gopalakrishnan Meena**, K. Taira, and K. Asai, "Low Reynolds number wake modification using a Gurney flap," 55th AIAA Aerospace Sciences Meeting, Grapevine, TX, Jan. 9-13, 2017 (AIAA 2017-0543) (link)

12. **M. Gopalakrishnan Meena**, A. Anandakrishnan, and M. A. Kavumcheril. "Numerical study on heat transfer and fluid flow in pin fin-dimple channels with fillet on dimple edge", ASME Gas Turbine India Conference, New Delhi, India, Dec. 15-17, 2014 (GTINDIA2014-8103) (link)

PRESENTATIONS

Underlined: Invited presentation

1. **M. Gopalakrishnan Meena**, Y. Zhang, W. Jiang, Y. Lin, S. Guenther, and X. Gao, "Towards a Quantum Algorithm for the Incompressible Nonlinear Navier–Stokes Equations", the Fifth IEEE International Conference on Quantum Computing and Engineering (QCE24), Montréal, Canada, September 14-21, 2024

2. **M. Gopalakrishnan Meena**, K. C. Gottiparthi, J. Lietz, A. Georgiadou, and E. A. Coello Pérez, "Solving the Hele–Shaw flow using the Harrow–Hassidim–Lloyd algorithm on superconducting devices: A study of efficiency and challenges," 2024 OLCF User Meeting, at Oak Ridge National Laboratory, TN, September 14-15, 2024

3. **M. Gopalakrishnan Meena**, "Graph-theoretic analysis and modeling of complex systems in fluid dynamics and mycology," *2024 Joint Mathematics Meetings*, January 3-6, 2024

4. **M. Gopalakrishnan Meena**, "Data-driven modeling of turbulent flows: Approaches using graph theory and machine learning," Institute of Eminence Program, Indian Institute of Technology Madras, December 19, 2023

5. **M. Gopalakrishnan Meena**, K. C. Gottiparthi, A. Georgiadou, M. R. Norman, and J. Lietz, "Quantum linear solvers for potential flow problems: assessing efficiency and challenges," *76th Annual Meeting of the APS Division of Fluid Dynamics*, Washington, DC, Nov. 19-21, 2023 (ZC17.00004)

6. A. Sahay, **M. Gopalakrishnan Meena**, and R. I. Sujith "Correlating hydrodynamic and acoustic fields in a turbulent combustor through community-based dimensionality reduction of vortical networks," *76th Annual Meeting of the APS Division of Fluid Dynamics*, Washington, DC, Nov. 19-21, 2023 (X05.00006)

7. **M. Gopalakrishnan Meena**, "Vortical network connectors for turbulence modification," Plasma Dynamics Group Seminar Series, University of Sheffield, September 28, 2023

8. **M. Gopalakrishnan Meena**, K. C. Gottiparthi, A. Georgiadou, J. Lietz, and M. R. Norman, "Numerical solutions to ideal fluid flow problems using quantum linear solvers," Oak Ridge Leadership Computing Facility 2023 Quantum Computing User Forum, Oak Ridge National Laboratory, TN, July 17-20, 2023

9. **M. Gopalakrishnan Meena**, "Physics-guided machine learning for image-based multi-material decomposition from dual-energy CT scans," Multimodal and Multi-scale Bioimaging for Biomedical and Bioenergy Research, NSLS-II, CFN & LBMS Users' Meeting (virtual), Brookhaven National Laboratory, NY, April 24-28, 2023

10. **M. Gopalakrishnan Meena**, "Physics guided machine learning for image-based multi-material decomposition from dual-energy CT scans," Advancing Medical Care through Discovery in the Physical Sciences: Radiation Detection, Joint DOE/NIH Workshop, Thomas Jefferson National Accelerator Facility, VA, March 15-17, 2023

11. **M. Gopalakrishnan Meena**, A. Simin, J. J. Riley, and S. M. de Bruyn Kops, "A machine learning approach for second moment closure modeling of stably stratified turbulence," APS March Meeting, Las Vegas, NV, March 5-10, 2023

12. **M. Gopalakrishnan Meena**, "Data-driven surrogate modeling of turbulent flows in the atmosphere and ocean," Mathematics in Computation (MiC) seminar series, Oak Ridge National Laboratory, February 9, 2023

13. **M. Gopalakrishnan Meena**, A. K. Ziabari, S. V. Venkatakrishnan, I. R. Lyngaas, M. R. Norman, B. Joo, T. L. Beck, C. A. Bouman, A. J. Kapadia, and X. Wang, "Physics guided machine learning for multi-material decomposition of tissues from dual-energy CT scans of simulated breast models with calcifications," High Performance Computing for Imaging Conference at Electronic Imaging Symposium, San Francisco, CA, January 15-19, 2023 (Selected for **Conference Best Paper Award** and **Symposium Highlights Session**)

14. M. R. Norman and **M. Gopalakrishnan Meena**, "Machine learned surrogate model for subgrid-scale effects in 3-D stratified Kelvin-Helmholtz turbulence using the miniWeatherML app", AGU Fall Meeting, Chicago, IL, December 12-16, 2022 (NG22B-0359)

15. **M. Gopalakrishnan Meena**, M. R. Norman, and D. M. Hall, "Subgrid-scale surrogate modeling of idealized atmospheric flows: A deep learned approach using high-resolution simulation data," 12th International Symposium on Turbulence and Shear Flow Phenomena, Osaka, Japan, July 19 - 22 (Online), 2022 (TSFP 12 229)

16. **M. Gopalakrishnan Meena**, M. J. Lane, J. Tannous, T. A. Rush, "Predicting production of known, putative, and unknown microbial metabolites through network analysis," 31st Fungal Genetics Conference, March 15-20, 2022 (Biotechnology-331V)

17. **M. Gopalakrishnan Meena**, "Data-driven modeling of turbulent flows: Approaches using graph theory & AI," *Data Sciences & Machine Intelligence Group Seminar*, Pacific Northwest National Laboratory, March 7, 2022

18. **M. Gopalakrishnan Meena**, M. R. Norman, and D. M. Hall, "Subgrid-scale surrogate modeling of cloud-like flows: An AI-based approach using high-resolution simulation data," AMS 102nd Annual Meeting, Virtual Conference, January 23-27, 2022 (paper # 13A.5)

19. **M. Gopalakrishnan Meena**, M. R. Norman, and D. M. Hall, "A deep learned subgrid-scale surrogate model for cloud-like flows from high-resolution simulation data," AGU Fall Meeting, Virtual Conference, December 13-17, 2021 (A15E-1689)

20. C.-A. Yeh, **M. Gopalakrishnan Meena**, and K. Taira, "Network-based resolvent analysis for modification of isotropic turbulence," 25th International Congress of Theoretical and Applied Mechanics, Milan, Italy, August 22-27, 2021

21. T. A. Rush, H. K. Shrestha, **M. Gopalakrishnan Meena**, M. K. Spangler, J. C. Ellis, J. Labbé, and P. E. Abraham, "Bioprospecting Trichoderma: A systematic roadmap to screen genomes and natural products for biocontrol applications", 9th Annual Oak Ridge Postdoctoral Association Research Symposium, July 29, 2021

22. M. R. Norman, C. Eldred, I. Lyngaas, **M. Gopalakrishnan Meena**, K. Pressel, M. Taylor, "Recent Developments for a New Cloud Resolving Model on the A-Grid," *PDEs on the Sphere*, Virtual Meeting, May 17-21, 2021

23. M. R. Norman, C. Eldred, W. Hannah, I. Lyngaas, **M. Gopalakrishnan Meena**, K. Pressel, M. Taylor, X. Yuan, "Developing a New Cloud Resolving Model for the E3SM-MMF ECP AD Project," *ECP Annual Meeting*, Virtual Meeting, April 12-16, 2021

24. **M. Gopalakrishnan Meena**, "Identifying vortical network connectors for turbulent flow modification," *Network Science for Fluid Mechanics Seminar Series*, Virtual Seminar Series, March 19, 2021

25. M. R. Norman and **M. Gopalakrishnan Meena**, "Confident, adaptable, and robust machine learning to augment traditional modeling and simulation," *ASCR Workshop on Reimagining Codesign*, Virtual Workshop, Mar. 16-18, 2021

26. C.-A. Yeh, **M. Gopalakrishnan Meena**, and K. Taira, "Network broadcast mode analysis and control of 2D decaying isotropic turbulence," *SIAM Conference on Computational Science and Engineering*, Virtual Conference, Mar.1-5, 2021 (MS275)

27. **M. Gopalakrishnan Meena** and K. Taira, "Modeling and modifying fluid flows using network-community-based techniques: laminar and turbulent flows," *SIAM Conference on Computational Science and Engineering*, Virtual Conference, Mar.1-5, 2021 (MS190)

28. **M. Gopalakrishnan Meena** and M. R. Norman, "Towards a Deep Learned Subgrid-scale Surrogate Model for Cloud Resolving Models from High-resolution Simulation Data," AMS 101st Annual Meeting, Virtual Conference, January 10-15, 2021 (paper # 6.9)

29. **M. Gopalakrishnan Meena** and M. R. Norman, "Towards a deep learned subgrid-scale surrogate model for stratified turbulence from high-resolution simulation data," AGU Fall Meeting, Virtual Conference, December 1-17, 2020 (A068-0013)

30. T. A. Rush, **M. Gopalakrishnan Meena**, J. Tannous, P. Abraham, R. Giannone, and J. Labbé, "Lipochitooligosaccharides (LCOs) are biotic stress factors in Aspergillus fumigatus," *14th Annual Vanderbilt Postdoctoral Association Symposium*, virtual symposium, October 29, 2020

31. **M. Gopalakrishnan Meena** and K. Taira, "Network-based identification of influential structures to modify turbulent flows," *Network Science for Fluid Dynamics*, virtual workshop, June 24-25, 2020

32. C.-A. Yeh, **M. Gopalakrishnan Meena**, and K. Taira "Broadcasting Mode Analysis for Turbulent Flow Modification," *Network Science for Fluid Dynamics*, virtual workshop, June 24-25, 2020

33. **M. Gopalakrishnan Meena** and K. Taira, "Network-based identification of influential structures to modify turbulent flows," *72th Annual Meeting of the APS Division of Fluid Dynamics*, Seattle, WA, Nov. 23-26, 2019 (H10.00010)

34. C.-A. Yeh, **M. Gopalakrishnan Meena**, and K. Taira, "Time-evolving network analysis of two-dimensional turbulence," IUTAM Symposium on Laminar-Turbulent Transition, London, UK, Sep. 2-6, 2019

35. **M. Gopalakrishnan Meena** and K. Taira, "Characterizing influential networked structures in isotropic turbulence," 11th International Symposium on Turbulence and Shear Flow Phenomena, Southampton, UK, July 30 - Aug. 2, 2019 (TSFP 11 235)

36. **M. Gopalakrishnan Meena** and K. Taira, "Characterizing three-dimensional homogenous isotropic turbulence network", *SoCal Fluids XIII*, UC Santa Barbara, 20 April, 2019

37. Z. Bai, N. B. Erichson, **M. Gopalakrishnan Meena**, K. Taira, and S. L. Brunton, "Sparse and randomized sampling methods for scalable turbulent flow networks," *71th Annual Meeting of the APS Division of Fluid Dynamics*, Atlanta, GA, Nov. 18-20, 2018 (G01.00004)

38. **M. Gopalakrishnan Meena** and K. Taira, "High-dimensional turbulence network characterization and modeling", *NetSci Conference*, Paris, France, June 13-15, 2018 (140)

39. K. Taira, **M. Gopalakrishnan Meena**, and A. G. Nair, "Community-based model reduction of unsteady vortical flows", *NetSci Conference*, Paris, France, June 13-15, 2018 (135)

40. **M. Gopalakrishnan Meena**, A. G. Nair, and K. Taira, "Vortex network community based reduced-order force model," *70th Annual Meeting of the APS Division of Fluid Dynamics*, Denver, CO, Nov. 19-21, 2017 (M1.00005)

41. **M. Gopalakrishnan Meena**, A. G. Nair, and K. Taira, "Network representation and analysis of bluff body wake," *SIAM Conference on Computational Science and Engineering*, Atlanta, GA, Feb. 27-Mar. 3, 2017 (MS110)

42. **M. Gopalakrishnan Meena**, K. Taira, and K. Asai, "Low Reynolds number wake modification using a Gurney flap," *55th AIAA Aerospace Sciences Meeting*, Grapevine, TX, Jan. 9-13, 2017 (AIAA 2017-0543)

43. A. G. Nair, **M. Gopalakrishnan Meena**, and K. Taira, "Vortical and modal network analysis of unsteady cylinder wake," *69th Annual Meeting of the APS Division of Fluid Dynamics*, Portland, OR, Nov. 20-22, 2016 (E8.00004)

44. **M. Gopalakrishnan Meena**, A. Anandakrishnan, and M. A. Kavumcheril. "Numerical study on heat transfer and fluid flow in pin fin-dimple channels with fillet on dimple edge", ASME Gas Turbine India Conference, New Delhi, India, Dec. 15-17, 2014 (GTINDIA2014-8103)

PROFESSIONAL & COMMUNITY SERVICES

Journal & Proposal Referee

• Journal of Fluid Mechanics • AIAA Journal • IEEE Journal of Biomedical & Health Informatics
• IEEE Access • Physica D • Physics Letters A • International Journal of Heat and Fluid Flow
• Journal of Applied Meteorology and Climatology • Partial Differential Equations in Applied Mathematics
• Progress in Computational Fluid Dynamics • DOE's ALCC - Science Review & Computational Readiness
• DOE's INCITE - Computational Readiness • ORNL Director's Discretionary Allocation
• NASA - Early Stage Innovations • IITM - Office of Industrial Consultancy & Sponsored Research

Workshop Organization

1. Workshop on Complex Networks and Applications to Fluid Dynamics (virtual), February 19-21, 2024 : Organizer (with Gaurav Chopra, Shruti Tandon, Aditya Nair, Kunihiko Taira, and R. I. Sujith) (https://ctcs.iitm.ac.in/cnfd-2024/)
2. APS March Meeting, March 2022: Session chair - "Fluids II" (march.aps.org/)
3. High Performance Computing for Imaging Conference at Electronic Imaging Symposium, January, 2023: Session chair - "AI Methods for Imaging" (www.imaging.org/Site/IST/Conferences/EI/EI2023/EI2023.aspx)
4. AMS Annual Meeting, January 2022: (1) Session chair - "AI in Weather and Climate Modeling: Bridging the Gap Between Theoretical Advances and Production Use" and (2) Session co-chair for 2 sessions (annual.ametsoc.org/index.cfm/2022/)
5. AGU Fall Meeting, December 2021: Session chair - "AI in Weather and Climate Modeling: From Theoretical Advances to Operational Use" (www.agu.org/Fall-Meeting)
6. Network Science for Fluid Mechanics Seminar Series (virtual), once every month, Nov. 2020 - Feb. 2023: Organizer (with Aditya Nair and Kunihiko Taira) (sites.google.com/g.ucla.edu/nsfm/)

Training Events

1. 2025 Winter Classic Invitational Student Cluster Competition, ORNL Challenge: M. Gopalakrishnan Meena et al., "Benchmarking a quantum linear systems algorithm" (repo)
2. AI tutorial at CTCS Group, IIT Madras 2023: M. Gopalakrishnan Meena, "Introduction to machine learning for fluid flows" (repo)
3. AI tutorial at OpenACC Summit 2022: M. R. Norman and M. Gopalakrishnan Meena, "Exploring Neural Network Surrogate Models with miniWeatherML" (repo)
4. Mentor at GPU Hackathons (www.gpuhackathons.org)
   (a) OLCF Hackathon, October 18, 25-27, 2021 (Team 3d3n_h4ck3r2)
   (b) Princeton Hackathon, June 2, 8-10, 2021 (Team SLEAP)

Mentorship

- 2024-present: Chao Lu, Postdoctoral Researcher (Oak Ridge National Laboratory)
  "Scalable quantum algorithms for solving PDEs"
- 2024-present: Nasik M Nafi, Postdoctoral Researcher (Oak Ridge National Laboratory)
  "Interpretable, generalizable, scalable machine-learned turbulence models"
- 2024: Vinnie Jones, High school student (Charlottesville High School)
  "Quantum linear solver algorithm"
- 2023-2024: Demetri Liousas, B.S. summer study and thesis co-advisor (University of Massachusetts Amherst)
  "Interpreting machine learning models of a parameterized system of ODEs"
- 2022-2023: Ankit Sahay, Ph.D. thesis co-mentoring (Indian Institute of Technology Madras)
  "Interaction of vortical communities in a turbulent thermoacoustic system"
- 2022: Andrew Simin, M.S. independent study (University of Massachusetts Amherst)
  "Modeling parameterized system of ODEs using machine learning"
- 2017: Tyler Pilet, NSF-REU student (Florida State University)
  "System identification of bubble collapse model"

Outreach & Volunteering

- Youth Outreach in STEM, Knoxville TN (www.yostem.org) (2021 - 2023)
- Oak Ridge Computer Science Girls, Oak Ridge TN (www.orcsgirls.org) (2021 - 2023)

- Buck Lake Elementary School, Tallahassee FL (2016, 2017)
- FSU AME Building Open House for the public, Tallahassee FL (2016, 2017)

HONORS/AWARDS/RECOGNITION

Research Funding & Computational Resource Awards

- LDRD (Funding; $500k), Oak Ridge National Laboratory, U.S. Department of Energy - "Trustworthy multiscale probabilistic turbulence foundation models", Role: Co-I; Year: 2025
- LDRD (Funding; $500k), Oak Ridge National Laboratory, U.S. Department of Energy - "DiffusiveINR: Energy-Efficient Foundation Model for 3D Inverse Scientific Imaging Problems", Role: Co-I; Year: 2025
- LDRD (Funding; $750k), Oak Ridge National Laboratory, U.S. Department of Energy - "Energy-Efficient Training for Large-Scale Vision Transformer Foundation Models", Role: Advisor; Year: 2025
- 2024 International Teams in the Space & Earth Sciences (Workshop funding), International Space Science Institute (ISSI); "Opening new avenues in identifying coherent structures and transport barriers in the magnetised solar plasma", Role: Collaborator; Year: 2025, 2026.
- NAIRR Pilot Allocation 2024 (Computing; 100k Summit node hours), National Artificial Intelligence Research Resource (NAIRR) - "Securing Healthcare Privacy: Rendering Large-Scale Unlearnable Medical Imaging Data to Prevent Data Leaks", Role: Co-PI; Year: 2024
- INCITE 2024 (Computing; 250k Frontier node hours), U.S. Department of Energy - "Extreme Resolution Brain Image Segmentation", Role: Co-PI; Year: 2024
- Quantum Computing User Program Access (Computing; Premium access to IBM, IonQ & Quantinuum), Oak Ridge Leadership Computing Facility, U.S. Department of Energy - "Quantum linear solvers for potential flow problems", Role: PI; Year: 2023-2024
- Director Reserve Award ERCAP (Computing; 2k Perlmutter node hours), National Energy Research Scientific Computing Center, U.S. Department of Energy - "Quantum linear solvers for potential flow problems: assessing efficiency and challenges", Role: Co-PI; Year: 2023, 2024
- LDRD-SEED (Funding; $200k), Oak Ridge National Laboratory, U.S. Department of Energy - "Advanced Tomographic Imaging Method for Multi-Material Decomposition and Artifact Removal", Role: Co-I; Year: 2023-2024
- LDRD (Funding; $250k), Oak Ridge National Laboratory, U.S. Department of Energy - "Physics-Informed 3D Self-supervised Zero-Shot Semantic Segmentation with Generative-Adversarial Networks", Role: Co-I; Year: 2023

Honors & Recognition

- 2024 - **Commercial copyright submission sponsored by ORNL, UT-Battelle**: M. Gopalakrishnan Meena, M. J. Lane, A. G. Geiger, and D. A. Jacobson "metnet-direct-auxiliary", Certificate of U.S. Copyright Registration, Copyright Number: 90000309, Registration number: TXU002420465.
- 2024 - ORNL News highlight about paper on plant-microbe interaction.
- 2023 - **Best Paper Award at the High Performance Computing for Imaging Conference at the 2023 Electronic Imaging Symposium** for the paper titled: M. Gopalakrishnan Meena et al., "Physics guided machine learning for multi-material decomposition of tissues from dual-energy CT scans of simulated breast models with calcifications". Also selected for **Symposium Highlights Session**.
- 2022 - **ORNL, UT-Battelle Supplemental Performance Award** for recognition of extraordinary accomplishment, exceeding expectations, rising above unforeseen challenges and going the extra mile to advance ORNL's missions. The highest standards of performance and significance of the work make the SPA a rare achievement in one's career at ORNL.
- 2022 - **Winner of the 2022 American Association of Physicists in Medicine (AAPM) Grand challenge**: Truth-Based CT Reconstruction Challenge (https://www.aapm.org/GrandChallenge/TrueCT). Press release at ORNL: https://www.olcf.ornl.gov/2022/08/15/ornlpurdue-team-wins-ct-imaging-competition/

- 2021 - **Invention disclosure sponsored by ORNL, UT-Battelle**: M. Gopalakrishnan Meena, M. J. Lane, J. Tannous, A. G. Geiger, D. A. Jacobson, T. A. Rush, "Using bipartite networks to determine interactions between analytes and chemical treatments", U.S. Nonprovisional Application No. 18/243,320, UTB Ref. 4963.1, WNJ Ref. 138974.209559-US