ANANTHA NARAYANAN SURESH BABU

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EDUCATION

PhD, Massachusetts Institute of Technology **2023 - Present**
Major: Mechanical Engineering & Computation, GPA: 5.00/5.00
Advisor: Prof. Pierre Lermusiaux

SM, Massachusetts Institute of Technology **2021 - 2023**
Major: Mechanical Engineering, GPA: 5.00/5.00
Thesis: Stochastic Sea Ice Modeling with the Dynamically Orthogonal Equations

B. Tech (with Hons.), Indian Institute of Technology (IIT) Madras **2016 - 2020**
Major: Mechanical Engineering, GPA: 9.56/10.00

RESEARCH INTERESTS

Fluid & ocean dynamics, Sea ice dynamics, Scientific machine learning, Generative modeling, Closure modeling, Nonlinear inference, Probabilistic modeling, Uncertainty quantification, Reduced-order modeling, Bayesian learning, Model learning

PUBLICATIONS

Suresh Babu, A.N., Sadam A., and Lermusiaux P.F.J. (2026) "Guided unconditional and conditional generative models for super-resolution and inference of Quasi-Geostrophic turbulence". Journal of Advances in Modeling Earth Systems, 18, e2025MS005324. DOI:10.1029/2025MS005324

Suresh Babu, A.N., Sadam A., and Lermusiaux, P.F.J. (2026). "Modified Dynamic Mixed Subgrid-scale Models for Geophysical Flows: Forced Two-Dimensional and β-plane Turbulence". Physical Review Fluids. Sub-judice.

Suresh Babu, A.N., Sadam A., and Lermusiaux, P.F.J. (2026). "Super-resolution-based stochastic generative closures for forced two-dimensional and β-plane turbulence". In preparation.

Suresh Babu, A.N., and Lermusiaux, P.F.J. (2026). "Stochastic sea ice modeling with the Dynamically Orthogonal equations: Theory and applications". In preparation.

Suresh Babu, A.N., Sadam A., and Lermusiaux P.F.J. (2025) "Evaluation of analytical turbulence closures for quasi-geostrophic ocean flows with coastal boundaries". OCEANS '25 IEEE/MTS Great Lakes, Chicago. DOI:10.23919/OCEANS59106.2025.11245082

Rajagopal, E., **Suresh Babu, A.N.**, Ryu, T., Haley, Jr., Mirabito, C., and Lermusiaux, P.F.J. (2023). "Evaluation of deep learning models towards ocean forecasting". OCEANS '23 IEEE/MTS Gulf Coast, Biloxi. DOI: 10.23919/OCEANS52994.2023.10337380

Suresh Babu, A.N., Rajan, A., Pramanik, R., and Arockiarajan, A. (2019). "A thermodynamically-consistent phenomenological viscoplastic model for hydrogels". Materials Research Express, 6(8), 085418. DOI: 10.1088/2053-1591/ab2a49

Pramanik, R., **Suresh Babu, A.N.**, Rajan, A., et al. (2019). "Theoretical modeling and experimental characterization of transversely isotropic hydrogels". International Journal of Engineering Science, 144, 103144. DOI: 10.1016/j.ijengsci.2019.103144

Rajan, A., Pramanik, R., **Suresh Babu, A.N.**, and Arockiarajan, A. (2019). "Mechanics of viscoelastic buckling in slender hydrogels". Materials Research Express, 6(5), 055320. DOI: 10.1088/2053-1591/ab0691

FELLOWSHIPS & AWARDS

Wunsch Silent Hoist & Crane Award (2026), MIT, for outstanding graduate research and education in mechanical engineering

MathWorks Mechanical Engineering Fellowship (2023-2024), (2024-2025), MIT, awarded to graduate students who actively use MathWorks software in their research

Travel Award (2025), USACM, awarded to attend the 18th U. S. National Congress on Computational Mechanics in Chicago, Illinois

Travel Award in Ocean Engineering (2025), MIT, awarded to attend the 18th U. S. National Congress on Computational Mechanics in Chicago, Illinois

Martin A. Abkowitz International Travel Fellowship in Ocean Engineering (2023), MIT, awarded to attend the SIAM Geosciences conference in Bergen, Norway

Homer A. Burnell Presidential Graduate Fellowship (2021), School of Engineering, MIT, awarded to outstanding incoming graduate students at MIT

MITACS Globalink Summer Research Fellowship (2019), awarded to pursue a fully funded 12-week research internship at the University of British Columbia, Vancouver

CONFERENCES

Presentations

"Generative models for super-resolution & inference of Quasi-Geostrophic turbulence and oceanic flows", 2026 Ocean Sciences Meeting, Glasgow, Scotland

"Physics-inspired neural architectures for forecasting fluid and oceanic flows", 18th U. S. National Congress on Computational Mechanics, Chicago, Illinois

"Stochastic modeling & learning for sea ice dynamics", 2024 SIAM Conference on Mathematics of Planet Earth, Portland, Oregon

"Probabilistic modeling & Bayesian learning for coupled sea ice-ocean dynamics", 17th U. S. National Congress on Computational Mechanics, Albuquerque, New Mexico

"Bayesian data assimilation & learning for coupled sea ice-ocean systems", 2023 SIAM Conference on Mathematical & Computational Issues in the Geosciences, Bergen, Norway

Posters & eLightning Talks

"Physics-inspired multiscale neural architectures for forecasting fluid and oceanic flows", 2026 Ocean Sciences Meeting, Glasgow, Scotland

"Probabilistic modeling & Bayesian learning for sea ice dynamics", 2024 Ocean Sciences Meeting, New Orleans, Louisiana

PROFESSIONAL SERVICE

Conference Organization

Mini-symposium Co-chair: "Machine Learning for Geosciences" — SIAM Geosciences 2025

Session Co-chair: "Neural Networks and Machine Learning" — SIAM Geosciences 2023

Reviewer: Journals

Artificial Intelligence for the Earth Systems — since 2026

Ocean Modelling, Modelling and Simulation in Materials Science and Engineering, — since 2024

Journal of Physics D: Applied Physics, Physica Scripta, Materials Research Express

Reviewer: Conferences and Proceedings

15th International Conference on Climate Informatics — 2026

NeurIPS/ICML Workshop on Structured Probabilistic Inference & Generative Modeling (SPIGM) — 2025, 2026

MENTORSHIP

MIT - Research Science Institute (RSI) High School Summer Program

Mentored 5 students from 2023 to 2026. One mentee (Jayveer Kocchhar) awarded "Top 5 Written Research Award (2025)".

PROFESSIONAL EXPERIENCE

Boston Consulting Group (BCG) — **Chennai, India**

Associate — *Nov. 2020 - Aug. 2021*

- Worked across industrial goods & public sectors.
- Designed and facilitated investments of over $ 200 Million for the largest sector-specific industrial park of an Asian government.
- Developed growth & product expansion strategies for a large Indian tractor manufacturer.

SOFTWARE AND SKILLS

PyTorch, Python, Shell scripting (Bash, Linux command line), HPC, MATLAB, ABAQUS (UMAT, VUMAT), Git