Romit Maulik

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Education

PhD. Mechanical & Aerospace Engineering, Oklahoma State University, 2019.

M.S. Mechanical & Aerospace Engineering, Oklahoma State University, 2015.

B.E. Mechanical Engineering, BIT Mesra - India, 2012.

Professional experience

Margaret Butler Postdoctoral Fellow - ALCF, Argonne National Laboratory, Jun, 2019 - Present.

Pre-doctoral Appointee - MCS, Argonne National Laboratory, Jan, 2019 - May, 2019

GRA - Computational Fluid Dynamics Laboratory, Oklahoma State University, Jan, 2016 - May, 2019.

GRA - Computational Biomechanics Laboratory, Oklahoma State University, Aug, 2013 - July, 2015.

GTA - Mechanical & Aerospace Engineering, Oklahoma State University, Jan, 2013 - Dec, 2018.

Design Engineer - Tata Technologies Limited, Pune, Aug,2012 - Aug,2013.

Research interests

Scaleable scientific machine learning for domain-specific applications.

Numerical methods for turbulence closures and reduced-order modeling.

High-performance computing.

Projects

1. **Romit Maulik** (PI), Turb-Net: Scaleable physics-informed deep learning for turbulence model development, Director's discretionary resource allocation, Argonne Leadership Computing Facility, Argonne National Laboratory.

Publications

In progress

1. **R. Maulik**, A. Mohan, B. Lusch, S. Madireddy, P. Balaprakash: Time-series learning of latent-space dynamics for reduced-order model closure, *arXiv preprint : 1906.07815*.
2. **R. Maulik**, O. San, J. Jacob: Connecting implicit and explicit large eddy simulations of two-dimensional turbulence through machine learning, *arXiv preprint : 1901.09329*.

3. B. Narayanan, **R. Maulik**, M. Zhou, H. Doana, P. Balaprakash, L. A. Curtiss, R. S. Assary: Protonation of Bio-oil Components from Accurate First principles Simulations and Graph-based neural networks.
4. **R. Maulik**, V. Rao, S. Madireddy, B. Lusch, P. Balaprakash: Using recurrent neural networks for nonlinear term computation in advection-dominated dynamical systems. *In preparation*
5. **R. Maulik**, S. Madireddy, B. Lusch, P. Balaprakash, S. Wild: Generative reduced-order models with adaptive augmentation of training data. *In preparation*
6. **R. Maulik**, B. Lusch, S. Madireddy, P. Balaprakash: Precise predictions of nonlinear dynamical systems using time-delay augmented LSTMs. *In preparation*

Peer-reviewed articles

1. **R.Maulik**, O.San: Numerical assessments of a parametric implicit large eddy simulation model, *Journal of Computational and Applied Mathematics* (forthcoming).
2. **R. Maulik**, O. San, J. Jacob, C. Crick: Online turbulence model classification for large eddy simulation using deep learning, *Journal of Fluid Mechanics*, 870, 784-812, 2019.
3. O.San, **R. Maulik**, M. Ahmed: An artificial neural network framework for reduced order modeling of transient flows, *Communications in Nonlinear Science and Numerical Simulation*, 77, 271-287, 2019.
4. **R. Maulik**, O. San, A. Rasheed, P. Vedula: Subgrid modeling for two-dimensional turbulence using artificial neural networks, *Journal of Fluid Mechanics*, 858, 122-144, 2019.
5. **R. Maulik**, O. San, A. Rasheed, P. Vedula: Data-driven deconvolution for large eddy simulation of Kraichnan turbulence, *Physics of Fluids*, 30, 125109, 2018.
6. O.San, **R.Maulik**: Stratified Kelvin-Helmholtz turbulence of compressible shear flows, *Nonlinear Processes in Geophysics*, 25, 457–476, 2018.
7. O.San, **R.Maulik**: Extreme learning machine for reduced order modeling of turbulent geophysical flows, *Physical Review E*, 97, 042322, 2018.
8. O.San, **R.Maulik**: Machine learning closures for model order reduction of thermal fluids, *Applied Mathematical Modelling*, https://doi.org/10.1016/j.apm.2018.03.037, 2018.
9. **R.Maulik**, O.San, R. Behera : An adaptive multilevel wavelet framework for scale-selective WENO reconstruction schemes, *International Journal of Numerical Methods in Fluids*, https://doi.org/10.1002/fld.4489, 2018.
10. O.San, **R.Maulik**: Neural network closure models for nonlinear model order reduction, *Advances in Computational Mathematics*, https://doi.org/10.1007/s1044, 2018.
11. **R.Maulik**, O.San: A neural network approach for the blind deconvolution of turbulent flows, *Journal of Fluid Mechanics*, 831, 151-181, 2017.
12. **R.Maulik**, O.San: A novel dynamic framework for subgrid-scale parametrization of mesoscale eddies in quasigeostrophic turbulent flows, *Computers and Mathematics with Applications*, 74, 420-445, 2017.
13. **R.Maulik**, O.San: Explicit and implicit LES closures for Burgers turbulence, *Journal of Computational and Applied Mathematics*, 327, 12-40, 2017.
14. **R.Maulik**, O.San: Resolution and Energy Dissipation Characteristics of Implicit LES and Explicit Filtering Models for Compressible Turbulence, *Fluids*, 2(2)-14, 2017.

15. **R.Maulik**, O.San: A dynamic subgrid-scale modeling framework for Boussinesq turbulence, *International Journal of Heat and Mass Transfer*, 108, 1656-1675, 2017.

16. **R.Maulik**, O.San: A dynamic framework for scale-aware parameterizations of eddy viscosity coefficient in two-dimensional turbulence, *International Journal of Computational Fluid Dynamics*, 31(2), 69-92, 2017.

17. **R.Maulik**, O.San: A stable and scale-aware dynamic modeling framework for subgrid-scale parameterizations of two-dimensional turbulence, *Computers & Fluids* 158, 11-38, 2016.

18. **R.Maulik**, O.San: Dynamic modeling of the horizontal eddy viscosity coefficient for quasigeostrophic ocean circulation problems, *Journal of Ocean Engineering and Science* 1, 300-324, 2016.

19. H. H. Marbini, **R. Maulik**: A biphasic transversely isotropic poroviscoelastic model for the unconfined compression of hydrated soft tissue, *Journal of Biomechanical Engineering* 138, 031003, 2016.

Workshop participation

1. Invited participant, US-Japan Workshop on Data-Driven Fluid Dynamics, Kobe, Japan, 2020

2. Invited participant, Department of Energy - AI for Science Townhall, Argonne National Laboratory, June 2019

3. Invited participant, Advances in PDEs: Theory, Computation and Application to CFD, ICERM, Brown University, RI, 2018

4. Invited participant, SDSC Summer program in HPC and Data Science, UC San Diego, 2017

Conference talks

1. **R. Maulik**, H. Sharma, S. Patel, E. Jennings, B. Lusch, P. Balaprakash, V. Vishwanath: Novel turbulence closures using physics-informed machine learning, Argonne Physical Sciences and Engineering Division, AI Townhall 2019.

2. **R.Maulik**, O.San, A. Rasheed, P. Vedula: Data-driven deconvolution for the sub-grid modeling of large eddy simulations of two-dimensional turbulence, SIAM-CSE, 2019.

3. **R.Maulik**, O.San, A. Rasheed, P. Vedula: Data-driven deconvolution for the large eddy simulation of Kraichnan turbulence, Bulletin of the American Physical Society 71, 2018.

4. **R.Maulik**, O.San, C. Bach: A computational investigation of the effect of ground clearance in vertical ducting systems, 2018, Purdue University, Herrick Labs Conferences 2018.

5. **R.Maulik**, O.San: A neural network approach for the blind deconvolution of turbulent flows, Bulletin of the American Physical Society 70, 2017.

6. **R.Maulik**, Ratikanta Behera, O.San: A generalized wavelet based grid-adaptive and scale-selective implementation of WENO schemes for conservation laws, Texas Applied Mathematics and Engineering Symposium 2017, The University of Texas, Austin.

7. **R.Maulik**, O.San: An explicit filtering framework based on Perona-Malik anisotropic diffusion for shock capturing and subgrid scale modeling of Burgers' turbulence, Bulletin of the American Physical Society 69, 2016.

8. **R.Maulik**, O.San: A dynamic hybrid subgrid-scale modeling framework for large eddy simulations, Bulletin of the American Physical Society 69, 2016.

9. O.San, **R.Maulik**: A dynamic framework for subgrid-scale parametrization of mesoscale eddies in geophysical flows, Bulletin of the American Physical Society 69, 2016.

Honors & awards

3rd Margaret Butler Fellow, Argonne Leadership Computing Facility, Argonne National Laboratory.

Best oral presentation, 2nd MAE Graduate Research Symposium, Oklahoma State University, 2018

SIAM Student Travel Award: 2019 SIAM Conference on Computational Science and Engineering, Spokane, WA, 2019.

Outstanding Graduate Student, College of Engineering Architecture and Technology, Oklahoma State University, 2018

Graduate College Robberson Summer Research Fellowship, Oklahoma State University, 2017

FGSA Travel Award for Excellence in Graduate Research, American Physical Society, 2017

SIAM TX-LA Travel Grant, Texas Applied Mathematics and Engineering Symposium, 2017

Graduate Student Travel Grant, American Physical Society - Division of Fluid Dynamics, 2017

Graduate Student Travel Grant, Graduate Program Student Government Authority, Oklahoma State University, 2017

John Brammer Fellowship, Oklahoma State University, 2016

Graduate College Top Tier Fellowship, Oklahoma State University, 2016

7th place in Worldsteel-SteelChallenge 8 - North American University Category, 2014.

Professional service & outreach

Reviewer - AIAA J., Comput. Physics Commun., Int. J. Comput. Fluid D., J. Fluid Mech., Phys. Fluids.

Program Committee - Argonne Data Science Project allocations : Reviewed allocation requests for 21 million core hours and 190 TB storage.

Co-organizer - Argonne National Laboratory - AI, Statistics and Machine Learning Journal Club

Session chair - SIAM Conference on Computational Science and Engineering, Spokane, WA, 2019.

Session chair - 2nd MAE Graduate Research Symposium, Oklahoma State University, 2018.

Organizer & Lecturer - 2-day TensorFlow workshop, Mechanical & Aerospace Engineering, 2018

Organizer - National Lab Day outreach, Computational Fluid Dynamics Laboratory, Oklahoma State University 2017, 2018.

Tutorial lead - Statistical methods for machine learning, ALCF AI4Science tutorial, Argonne National Laboratory.