Jin-Long WU

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Education

Sep. 2014-Sep. 2018	Virginia Tech	Ph.D.
	Major: Aerospace Engineering (Advisor: Prof. Heng Xiao)	GPA 3.96/4.0
Sep. 2011-Jun. 2014	Southeast University, China	M.S.
	Major: Power Engineering	GPA 93.0/100; Rank 1/150
Sep. 2007-Jun. 2011	Southeast University, China	B.S.
	Major: Thermal Energy and Power Engineering	

Research Experiences

Jan. 2019 -	California Institute of Technology	Postdoctoral Scholar
	Supervisors: Prof. Andrew Stuart, Prof. Tapio Schneider	
Sep. 2018-Dec. 2018	University of California, Los Angeles	Visiting Scholar
	Host: Institute for Pure and Applied Mathematics	
May. 2018-Aug. 2018	Lawrence Berkeley National Laboratory	Summer Intern
	Supervisor: Dr. Prabhat	
Jun. 2016-Jul. 2016	Stanford University	Visiting Student
	Host: Center for Turbulence Research	

Research Interests

Physics-Informed Machine Learning, Bayesian Inference, Turbulence, Computational Fluid Dynamics, Climate Dynamics, Uncertainty Quantification, Data Assimilation, Inverse Problems, Stochastic Modeling, Multi-Scale Modeling

Publications

Journal Papers (published or accepted)

- **J.-L. Wu**, K. Kashinath, A. Albert, D. Chirila, Prabhat, H. Xiao. "Enforcing Statistical Constraints in Generative Adversarial Networks for Modeling Chaotic Dynamical Systems". Journal of Computational Physics, 406 (2020): 109209.
- **J.-L. Wu**, H. Xiao, R. Sun, Qiqi Wang. "Reynolds-Averaged Navier-Stokes Equations with Explicit Data-Driven Reynolds Stress Closure Can Be Ill-Conditioned". Journal of Fluid Mechanics 869 (2019): 553-586.
- **J.-L. Wu**, R. Sun, S. Laizet, H. Xiao. "Representation of Stress Tensor Perturbations with Application in Machine-Learning-Assisted Turbulence Modeling". Computer Methods in Applied Mechanics and Engineering, 346 (2019): 707-726.
- **J.-L. Wu**, C. Michelen, H. Xiao. "Physics-Informed Covariance Kernel for Model-Form Uncertainty Quantification with Application to Turbulent Flows". Computers & Fluids (2019): 104292.
- **J.-L. Wu**, H. Xiao, E. Paterson. "Physics-Informed Machine Learning Approach for Augmenting Turbulence Models:

A Comprehensive Framework". Physical Review Fluids 3.7 (2018): 074602.

- **J.-L. Wu**, X.-L. Yin, H. Xiao. "Seeing Transport Properties from Images: Fast Prediction of Porous Media Permeability with Convolutional Neural Networks". Science Bulletin, 63.18 (2018): 1215-1222. (Invited Paper)
- **J.-L. Wu**, J.-X. Wang, H. Xiao, J. Ling. "A Priori Assessment of Prediction Confidence for Data-Driven Turbulence Modeling". Flow, Turbulence and Combustion 99.1 (2017): 25-46.
- **J.-L. Wu**, J.-X. Wang, H. Xiao. "A Bayesian Calibration–Prediction Method for Reducing Model-Form Uncertainties with Application in RANS Simulations". Flow, Turbulence and Combustion 97.3 (2016): 761-786.
- H. Xiao, **J.-L. Wu**, S. Laizet, L. Duan, "Flows Over Periodic Hills of Parameterized Geometries: Datasets for Data-Driven Turbulence Modeling from Direct Simulations". Computers & Fluids (2020): 104431.
- C. Michelen, **J.-L. Wu**, H. Xiao, E. Paterson. "Data-Driven, Physics-Based Feature Extraction from Fluid Flow Fields Using Convolutional Neural Networks". Communications in Computational Physics, 25.3 (2019): 625-650.
- J.-X. Wang, **J.-L. Wu**, H. Xiao. "Physics-Informed Machine Learning Approach for Reconstructing Reynolds Stress Modeling Discrepancies Based on DNS Data". Physical Review Fluids 2.3 (2017): 034603.
- H. Xiao, **J.-L. Wu**, J.-X. Wang, R. Sun, C.J. Roy. "Quantifying and Reducing Model-Form Uncertainties in Reynolds-Averaged Navier–Stokes Simulations: A Data-Driven, Physics-Informed Bayesian Approach". Journal of Computational Physics 324 (2016): 115-136.
- J.-X. Wang, **J.-L. Wu**, H. Xiao. "Incorporating Prior Knowledge for Quantifying and Reducing Model-Form Uncertainties in RANS Simulations". International Journal for Uncertainty Quantification 6.2 (2016): 109-126.

Journal Papers (submitted or under revision)

- T. Schneider, A.M. Stuart, **J.-L. Wu**[a], "Imposing Sparsity Within Ensemble Kalman Inversion". Submitted, 2020.
- T. Schneider, A.M. Stuart, **J.-L. Wu**[a], "Learning Stochastic Closures Using Ensemble Kalman Inversion". Submitted, 2020.
- Y. Zeng, **J.-L. Wu**, H. Xiao, "Enforcing Deterministic Constraints on Generative Adversarial Networks for Emulating Physical Systems". Submitted, 2020.

Conference Papers

- **J.-L. Wu**, J.-X. Wang, H. Xiao, and J. Ling, "Visualization of High Dimensional Turbulence Simulation Data Using t-SNE", in 19th AIAA Non-Deterministic Approaches Conference, 2017. Grapevine, TX, 2017 (AIAA, Reston, VA, 2017), paper 2017-1770.
- H. Xiao, **J.-L. Wu**, J.-X. Wang, E. Paterson. "Physics-Informed Machine Learning for Predictive Turbulence Modeling: Progress and Perspectives", AIAA SciTech Meeting 2017. Grapevine, TX, 2017 (AIAA, Reston, VA, 2017), paper 2017-1712.
- J.-X. Wang, **J.-L. Wu**, J. Ling, G. Iaccarino, H. Xiao, "Physics-Informed Machine Learning for Predictive Turbulence Modeling: Toward a Complete Framework", tech. rep., Proceedings of Summer Research Program, Center of Turbulence Research, Stanford University, Stanford, CA, USA, 2016.

Presentations

Invited Talks

- **J.-L. Wu**, J.-X. Wang, H. Xiao. Physics-Informed Machine Learning for Turbulence Modeling. — UT Austin, Jun. 2019
- **J.-L. Wu**, J.-X. Wang, H. Xiao. Predictive Turbulence Modeling with Bayesian Inference and Physics-Informed Machine Learning — Heidelberg, May. 2019

[a] This paper is submitted to a mathematics journal and author names are listed alphabetically

- **J.-L. Wu**, J.-X. Wang, H. Xiao. Data-Driven Turbulence Modeling with Bayesian Inference and Physics-Informed Machine Learning. IPAM, UCLA, Nov. 2018
- **J.-L. Wu**, J.-X. Wang, H. Xiao. Predictive Turbulence Modeling with Bayesian Inference and Physics-Informed Machine Learning Caltech, Oct. 2018

Conference Talks

- **J.-L. Wu**, T. Schneider, A. Stuart. Estimating model-form uncertainty for multi-scale systems. APS DFD, Nov. 2019
- **J.-L. Wu**, Y. Zeng, K. Kashinath, A. Albert, Prabhat, H. Xiao. Enforcing Physical Constraints in Machine Learning with Application to Fluid Flows. SIAM CSE, Feb. 2019
- **J.-L. Wu**, Y. Zeng, K. Kashinath, A. Albert, Prabhat, H. Xiao. Physics-Informed Generative Learning to Predict Unresolved Physics in Complex Systems. APS DFD, Nov. 2018
- **J.-L. Wu**, C. Michelen, J.-X. Wang, H. Xiao. Reducing Model Discrepancies in Turbulent Flow Simulations with Physics-informed Machine Learning. SIAM UQ, Apr. 2018
- **J.-L. Wu**, R. Run, Q.-Q. Wang, H. Xiao. On the Conditioning of Machine-Learning-Assisted Turbulence Modeling. APS DFD, Nov. 2017
- **J.-L. Wu**, J.-X. Wang, H. Xiao. Reducing Model Discrepancy in Turbulent Flow Simulations: A Physics-Informed Machine Learning Approach. SIAM CSE, Feb. 2017
- **J.-L. Wu**, J.-X. Wang, H. Xiao, J. Ling. Visualization of High Dimensional Turbulence Simulation Data using t-SNE. AIAA SciTech, Jan. 2017
- **J.-L. Wu**, J.-X. Wang, H. Xiao. Quantifying the Discrepancy in RANS Modeling of Reynolds Stress Eigenvectors System. APS DFD, Nov. 2016

Teaching Experiences (As Teaching Assistant)

Caltech

- ACM 154: Inverse Problems and Data Assimilation Fall 2019

Virginia Tech

- AOE 5984: Machine Learning and Uncertainty Quantification Fall 2017
- AOE 4154: Aerospace Engineering Laboratory Fall 2017, 2016, 2014
- AOE 3054: Experimental Methods Spring 2018, 2017, 2015

Journal Review Experiences

- Physical Review Letters
- Journal of Fluid Mechanics
- Water Resources Research
- Physical Review E
- Applied Mathematical Modeling
- Aerospace Science and Technology
- Journal of Computational Physics
- Physical Review Fluids
- Flow, Turbulence and Combustion
- Journal of Verification, Validation and Uncertainty Quantification
- Advanced Powder Technology
- Communications in Computational Physics

Awards

- 2018 Paul E. Torgersen Graduate Student Research Excellence Award May. 2018
- Society for Industrial and Applied Mathematics Travel Award Mar. 2017, Apr. 2018, Mar. 2019

- American Physical Society DFD Travel Award — Nov. 2016
- Pratt Fellowship — 2014-2015, 2018-2019

Proposal Experiences (Assist my Ph.D. advisor)

- DARPA Artificial Intelligence Research Associate — 1 proposal, 2018
- DARPA Artificial Intelligence Exploration — 1 proposal, 2018
- NSF Faculty Early Career Development Program — 1 proposal, 2017
- NASA Early Career Faculty Program — 1 proposal, 2017

Workshops and Symposiums

As mini-symposium organizer / workshop instructor

- SIAM Mathematics for Planetary Earth 2020 (co-organize with Dr. Yair Cohen) — Aug. 2020
- Machine Learning for Geosciences Workshop at AGU Fall Meeting 2019 (instructor) — Dec. 2019

As participant

- Computational Statistics and Data-Driven Models, ICERM, Brown University — Apr. 2020
- Machine Learning and Uncertainty Quantification, USC — Jul. 2019
- Frontiers of Deep Learning, Simons Institute, Berkeley — Jul. 2019
- Deep Learning Summer School, Lawrence Berkeley National Laboratory — Jul. 2019
- Scientific Machine Learning, ICERM, Brown University — Jan. 2019
- Bay Area Machine Learning Symposium, Facebook — Oct. 2018
- Data Science Institute Workshop, Lawrence Livermore National Laboratory — Aug. 2018
- 2nd Physics Informed Machine Learning Workshop, Los Alamos National Laboratory — Jan. 2018
- Advances in Turbulence Modeling, University of Michigan — Jul. 2017

Memberships

- The Honor Society of Phi Kappa Phi, Graduate Student Member — 2017-present
- Tau Beta Pi the Engineering Honor Society, Graduate Student Member — 2016-present
- American Geophysical Union, Graduate Student Member — 2018-present
- Society for Industrial and Applied Mathematics, Graduate Student Member — 2016-present
- American Institute of Aeronautics and Astronautics, Graduate Student Member — 2016-present
- American Physical Society, Graduate Student Member — 2015-present

Certificates

- Deep Learning Specialization — By deeplearning.ai on Coursera
- Structuring Machine Learning Projects — By deeplearning.ai on Coursera
- Convolutional Neural Networks — By deeplearning.ai on Coursera
- Sequence Models — By deeplearning.ai on Coursera
- Improving Deep Neural Networks: Hyperparameters tuning, Regularization and Optimization — By deeplearning.ai on Coursera
- Neural Networks and Deep Learning — By deeplearning.ai on Coursera
- Machine Learning — By Stanford University on Coursera