

# Jinlong Wu

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## Education

Sep. 2014-Sep. 2018	Virginia Tech Major: Aerospace Engineering (Advisor: Prof. Heng Xiao)	Ph.D.
Sep. 2011-Jun. 2014	Southeast University, China Major: Power Engineering	Master
Sep. 2007-Jun. 2011	Southeast University, China Major: Thermal Energy and Power Engineering	Bachelor

## Work Experiences

Aug. 2022-present	Department of Mechanical Engineering University of Wisconsin-Madison	Assistant Professor
Aug. 2021-July. 2022	California Institute of Technology Supervisors: Prof. Andrew Stuart, Prof. Tapio Schneider	Research Scientist
Jan. 2019-July. 2021	California Institute of Technology Supervisors: Prof. Andrew Stuart, Prof. Tapio Schneider	Postdoctoral Scholar
Sep. 2018-Dec. 2018	University of California, Los Angeles Host: Institute for Pure and Applied Mathematics	Visiting Scholar
May. 2018-Aug. 2018	Lawrence Berkeley National Laboratory Supervisor: Dr. Prabhat Ram	Summer Intern

## Research Interests

Scientific Machine Learning, Data Assimilation, Computational Fluid Dynamics, Turbulence, Stochastic Processes, Bayesian Inference, Uncertainty Quantification, Inverse Problems, Multiscale Modeling

## Publications<sup>a</sup>

### Journal Papers (published or accepted)

- T. Schneider, A.M. Stuart, **J.-L. Wu**<sup>b</sup>, “Ensemble Kalman Inversion for Sparse Learning of Dynamical Systems from Time-Averaged Data”. *Journal of Computational Physics* (2022).
- T. Schneider, O. Dunbar, **J.-L. Wu**, L. Bottcher, D. Burov, A. Garbuno-Inigo, G. Wagner, S. Pei, C. Daraio, R. Ferrari, J. Shaman, “Epidemic Management and Control Through Risk-Dependent Individual Contact Interventions”. *PLOS Computational Biology* (2022).

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<sup>a</sup> More details can be found on my [Google Scholar Profile](#).

<sup>b</sup> Author names are listed alphabetically.

- T. Schneider, A.M. Stuart, **J.-L. Wu**<sup>b</sup>, “Learning Stochastic Closures Using Ensemble Kalman Inversion”. *Transactions of Mathematics and Its Applications* (2021).
- K. Kashinath, M. Mustafa, A. Albert, **J.-L. Wu**, et al., “Physics-Informed Machine Learning: Case Studies for Weather and Climate Modeling”. *Philosophical Transactions of the Royal Society A* (2021).
- Y. Zeng, **J.-L. Wu**, H. Xiao, “Enforcing Deterministic Constraints on Generative Adversarial Networks for Emulating Physical Systems”, *Communications in Computational Physics* (2021).
- **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* (2020).
- 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).
- **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* (2019).
- **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*, (2019).
- **J.-L. Wu**, C. Michelen, H. Xiao. “Physics-Informed Covariance Kernel for Model-Form Uncertainty Quantification with Application to Turbulent Flows”. *Computers & Fluids* (2019).
- 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*, (2019).
- X.-L. Zhang, **J.-L. Wu**, O. Coutier-Delgosha, H. Xiao, “Recent Progress in Augmenting Turbulence Models with Physics-Informed Machine Learning”. *Journal of Hydrodynamics*, (2019).
- **J.-L. Wu**, H. Xiao, E. Paterson. “Physics-Informed Machine Learning Approach for Augmenting Turbulence Models: A Comprehensive Framework”. *Physical Review Fluids* (2018).
- **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* (2018).
- **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* (2017).
- 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* (2017).
- **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* (2016).
- 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* (2016).
- 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* (2016).

## Conference Papers

- **J.-L. Wu**, J.-X. Wang, H. Xiao, and J. Ling, “Visualization of High Dimensional Turbulence Simulation Data Using t-SNE”, 19th AIAA Non-Deterministic Approaches Conference. Grapevine, TX, 2017.
- H. Xiao, **J.-L. Wu**, J.-X. Wang, E. Paterson. “Physics-Informed Machine Learning for Predictive Turbulence Modeling: Progress and Perspectives”, AIAA SciTech Meeting. Grapevine, TX, 2017.
- 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.** Data-Driven Closure Modeling Using Derivative-free Kalman Methods. Alan Turing Institute, July. 2022
- **J.-L. Wu.** Closure Modeling of Dynamical Systems Using Bayesian Inference and Physics-Informed Machine Learning. Google Research, Aug. 2021
- **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
- **J.-L. Wu, J.-X. Wang, H. Xiao.** Data-Driven Turbulence Modeling with Bayesian Inference and Physics-Informed Machine Learning. 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

### Selected Conference Talks

- **J.-L. Wu, T. Schneider, A. Stuart.** Learning Stochastic Closures Using Sparsity-Promoting Ensemble Kalman Inversion. AMS, Mar. 2022
- **J.-L. Wu, Z. Huang, Z. Shen, T. Schneider, A. Stuart.** Data-driven modeling of non-local mixing phenomena in geophysical flows. APS DFD, Nov. 2021
- **J.-L. Wu, T. Schneider, A. Stuart.** Estimating model error using sparsity-promoting ensemble Kalman inversion. APS DFD, Nov. 2020
- **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

## Teaching Experiences

### University of Wisconsin-Madison

- ME563: Intermediate Fluid Dynamics. Spring 2023
- ME 964: Scientific Computing and Machine Learning for Engineering. Fall 2022

### Caltech (As Teaching Assistant)

- ACM 154: Inverse Problems and Data Assimilation. Fall 2019

### Virginia Tech (As Teaching Assistant)

- 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

## **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

## **Journal Review Experiences**

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

## **Workshops and Symposiums**

- International Congress on Industrial and Applied Mathematics (co-organize with Prof. Peng Chen) Aug. 2023
- SIAM Mathematics of Data Science 2022 (co-organize with Dr. Daniel Huang) Sep. 2022
- 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

## **Memberships**

- Tau Beta Pi the Engineering Honor Society, Member 2016-present
- American Geophysical Union, Member 2018-present
- Society for Industrial and Applied Mathematics, Member 2016-present
- American Physical Society, 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
- 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