# Jinlong Wu

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## Education

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

## Work Experiences

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|---|---|---|
| Aug. 2022-present | Department of Mechanical Engineering<br>University of Wisconsin-Madison | Assistant Professor |
| Aug. 2021-July. 2022 | California Institute of Technology<br>Supervisors: Prof. Andrew Stuart, Prof. Tapio Schneider | Research Scientist |
| Jan. 2019-July. 2021 | California Institute of Technology<br>Supervisors: Prof. Andrew Stuart, Prof. Tapio Schneider | Postdoctoral Scholar |
| Sep. 2018-Dec. 2018 | University of California, Los Angeles<br>Host: Institute for Pure and Applied Mathematics | Visiting Scholar |
| May. 2018-Aug. 2018 | Lawrence Berkeley National Laboratory<br>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[a]

### Journal Papers (published or accepted)

- T. Schneider, A.M. Stuart, **J.-L. Wu**[b], "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).

[a] More details can be found on my Google Scholar Profile.

[b] Author names are listed alphabetically.

- T. Schneider, A.M. Stuart, **J.-L. Wu**[b], "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).

## Journal Papers (submitted or under revision)

- **J.-L. Wu**, M. Levine, T. Schneider, A.M. Stuart, "Learning about Structural Errors in Models of Complex Dynamical Systems". To be submitted (2022).

## 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

- 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

- 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