Jinlong Wu

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Education

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

Work Experiences

Aug. 2022-present	Department of Mechanical Engineering	Assistant Professor
Mar. 2023-present	Data Science Institute	Affiliated Faculty
	University of Wisconsin-Madison	
Aug. 2021-July. 2022	California Institute of Technology	Research Scientist
	Supervisors: Prof. Andrew Stuart, Prof. Tapio Schneider	
Jan. 2019-July. 2021	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 Ram	

Research Interests

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

Publications[a]

Journal Papers

- X. Dong, C. Chen, **J.-L. Wu**, "Data-Driven Stochastic Closure Modeling via Conditional Diffusion Model and Neural Operator". Submitted to Journal of Computational Physics (2024).
- C. Chen, **J.-L. Wu**, "Operator Learning for Continuous Spatial-Temporal Model with A Hybrid Optimization Scheme", Submitted to Journal of Computational Physics (2024).
- C. Chen, N. Chen, **J.-L. Wu**, "CGNSDE: Conditional Gaussian Neural Stochastic Differential Equation for Modeling Complex Systems and Data Assimilation". Computer Physics Communications (2024).

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

- J. Wang, S. Wang, H. Unjhawala, **J.-L. Wu**, D. Negrut, "MBD-NODE: physics-informed data-driven modeling and simulation of constrained multibody systems". Multibody System Dynamics (2024).
- H. Unjhawala, T. Hansen, H. Zhang, S. Caldraru, S. Chatterjee, L. Bakke, **J.-L. Wu**, R. Serban, D. Negrut, "An expeditious and expressive vehicle dynamics model for applications in controls and reinforcement learning". IEEE Access (2024).
- **J.-L. Wu**, M. Levine, T. Schneider, A. Stuart, "Learning About Structural Errors in Models of Complex Dynamical Systems". Journal of Computational Physics (2023).
- C. Chen, N. Chen, **J.-L. Wu**, "CEBoosting: Online Sparse Identification of Dynamical Systems with Regime Switching by Causation Entropy Boosting". Chaos (2023).
- H.M. Unjhawala, R. Zhang, W. Hu, **J.-L. Wu**, R. Serban, D. Negrut, "Using a Bayesian-Inference Approach to Calibrating Models for Simulation in Robotics". Journal of Computational and Nonlinear Dynamics (2023).
- R Oliver, I Lopez-Gomez, A Garbuno-Iñigo, DZ Huang, E Bach, **J.-L. Wu**, "EnsembleKalmanProcesses. jl: Derivative-free ensemble-based model calibration". Journal of Open Source Software (2022).
- 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).
- 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).

[b] Author names are listed alphabetically.

- **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**. Operator learning for data-driven closure models of complex dynamical systems. — Iowa State University, May. 2024
- **J.-L. Wu**. Data-Driven Closure Modeling Using Derivative-free Kalman Methods. — Lawrence Livermore National Laboratory, Oct. 2023
- **J.-L. Wu**. Data-Driven Closure Modeling with Limited Data. — Argonne National Laboratory, Jun. 2023
- **J.-L. Wu**. Data-Driven Closure Modeling Using Derivative-Free Kalman Methods — University of Iowa, Oct. 2022
- **J.-L. Wu**. Data-Driven Closure Modeling Using Derivative-free Kalman Methods. — Alan Turing Institute, Jul. 2022
- **J.-L. Wu**. Data-Driven Closure Modeling Using Derivative-free Kalman Methods. — Southeast University, Jun. 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

- X. Dong, C. Chen**, J.-L. Wu**. Data-Driven Modeling for Stochastic Closures of Complex Dynamical Systems. — SIAM UQ, Mar. 2024
- C. Chen, N. Chen, **J.-L. Wu**. Online Sparse Identification of Dynamical Systems with Regime Switching by Causation Entropy Boosting. — APS DFD, Nov 2023
- **J.-L. Wu**, T. Schneider, A. Stuart. Learning Stochastic Closures Using Sparsity-Promoting Ensemble Kalman Inversion. — SIAM MDS, Sep. 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 363: Fluid Dynamics — Fall 2023, Fall 2024
- ME 563: Intermediate Fluid Dynamics — Spring 2023
- ME 964: Scientific Computing and Machine Learning for Engineering — Fall 2022, Fall 2023

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

Journal Review Experiences

- Nature Computational Science
- Physical Review Letters
- Computer Methods in Applied Mechanics and Engineering
- Journal of Fluid Mechanics
- SIAM Journal on Scientific Computing
- Scientific Reports
- Journal of Computational Physics
- Journal of Advances in Modeling Earth Systems
- Physical Review Fluids
- Physical Review E

- Water Resources Research
- Flow, Turbulence and Combustion
- Aerospace Science and Technology
- Journal of Verification, Validation and Uncertainty Quantification
- Advanced Powder Technology
- Communications in Computational Physics

Workshops and Symposiums

- Special Session at 14th American Institute of Mathematical Sciences (AIMS) Conference (co-organize with Prof. Nan Chen) Dec. 2024
- Minisymposium at SIAM Uncertainty Quantification 2024 (co-organize with Prof. Xin T. Tong) Mar. 2024
- Minisymposium at International Congress on Industrial and Applied Mathematics (co-organize with Prof. Peng Chen) Aug. 2023
- Minisymposium at SIAM Mathematics of Data Science 2022 (co-organize with Dr. Daniel Huang) Sep. 2022
- Minisymposium at 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