SEUNG WHAN CHUNG

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EDUCATION

University of Illinois at Urbana-Champaign *January 2017 - August 2021*
Ph. D in Theoretical and Applied Mechanics GPA: 4.0/4.0
University of Illinois at Urbana-Champaign *August 2014 - December 2016*
M. S in Theoretical and Applied Mechanics GPA: 3.88/4.0
Seoul National University *March 2008 - February 2014*
B. S. in Mechanical and Aerospace Engineering (Summa cum laude) GPA: 3.96/4.3

RESEARCH

○ **Lawrence Livermore National Laboratory** April 2024 - Present
Computational Scientist Livermore, CA

○ **Lawrence Livermore National Laboratory** January 2023 - March 2024
Postdoctoral Staff Member Livermore, CA

· Developed a scalable reduced order model with discontinuous Galerkin domain decomposition
· Orchestrated the development of `pylibROM`, python interface for the library of reduced order modeling
· Advised and mentored three student interns (Ping-Hsuan Tsai, Seung-Won Suh, Axel Larsson)

○ **University of Texas at Austin** September 2021 - December 2022
Postdoctoral Fellow (with Prof. R. Moser, Prof. L. Raja, Dr. T. Oliver) Austin, TX

· Uncertainty quantification of electron-argon collision cross sections via Bayesian inference
· Physics-based reduced-modeling of inductively-coupled argon plasma torch
· Developed a discontinuous-Galerkin HPC solver for large-scale non-equilibrium plasma simulations

○ **University of Illinois at Urbana-Champaign** January 2015 - August 2021
Graduate Researcher (with Prof. Jonathan Freund) Urbana, IL

· Developed multi-point penalty-based optimization framework for chaotic turbulent flows.
· Implemented and validated turbulence statistics and sound radiation of a compressible Mach-1.3 jet.

○ **Sandia National Laboratories** January 2017 - May 2017
Student Intern (with Dr. Stephen D. Bond, Dr. Eric C. Cyr) Albuquerque, NM

· Developed a novel regular gradient computing method for chaotic particle plasma simulations.
· Demonstrated gradient computation for Debye shielding response and sheath edge formation.

SKILLS

Computer Languages	Python, C++, MATLAB, Fortran, pybind11
Parallel Programming	MPI
Simulation Libraries	`MFEM`, `libROM`, `Gmsh`
Scripting	Python, Bash, Flux
Version Control	Git, Docker
Documentation	LaTeX, Vi/Vim, Mendeley
Visualization and I/O	PLOT3D, HDF5, Paraview
Presentation	Beamer, Keynote, Adobe Illustrator/Premiere

PUBLICATIONS

S. W. Chung, C. Miller, Y. Choi, P. Tranquilli, H. K. Springer & K. Sullivan, "Latent Space Dynamics Identification for Interface Tracking with Application to Shock-Induced Pore Collapse," *arXiv preprint*, arXiv:2507.10647, (2025).

W. Anderson, **S. W. Chung**, & Y. Choi, "mLaSDI: Multi-stage latent space dynamics identification," *arXiv preprint*, arXiv:2506.09207, (2025).

Y. Choi *et al.* (**S. W. Chung**) "Defining Foundation Models for Computational Science: A Call for Clarity and Rigor," *arXiv preprint*, arXiv:2505.22904, (2025).

S. W. Chung, T. A. Oliver, L. Raja & R. D. Moser, "Characterization of uncertainties in electron-argon collision cross sections," *Plasma Sources Science and Technology*, (2025).

N. A. Petersson, S. Günther & **S. W. Chung**, "A time-parallel multiple-shooting method for large-scale quantum optimal control," *Journal of Computational Physics* (2025) 113712.

T. Moore, A. A. Wong, B. Giera *et al.* (**S. W. Chung**) "Accelerating climate technologies through the science of scale-up," *Nature Chemical Engineering* (2024).

S. W. Cheung, Y. Choi, **S. W. Chung**, J.-L. Fattebert, C. Kendrick, & D. Osei-Kuffuor, "Theory and numerics of subspace approximation of eigenvalue problems," *Applied Mathematics and Computation*, 511, (2026) 129722.

I. Zanardi, A. N. Diaz, S. W. Chung, M. Panesi, & Y. Choi, "Scalable nonlinear manifold reduced order model for dynamical systems," *arXiv preprint*, arXiv:2412.00507, (2024)

S. W. Chung, Y. Choi, P. Roy, T. Roy, T. Lin, D. T. Nguyen, C. Hahn, E. B. Duoss & S. E. Baker "Scaled-up prediction of steady Navier-Stokes equation with component reduced order modeling," *arXiv preprint*, arXiv:2410.21534, (2024).

S. W. Chung, Y. Choi, P. Roy, T. Roy, T. Lin, D. T. Nguyen, C. Hahn, E. B. Duoss & S. E. Baker "Scalable physics-guided data-driven component model reduction for steady Navier-Stokes flow," *arXiv preprint*, arXiv:2410.21583, (2024).

D. Chakraborty, **S. W. Chung** & R. Maulik, "Divide And Conquer: Learning Chaotic Dynamical Systems With Multistep Penalty Neural Ordinary Differential Equations," *Computer Methods in Applied Mechanics and Engineering*, (2024).

S. W. Chung, Y. Choi, P. Roy, T. Moore, T. Roy, T. Lin, D. T. Nguyen, C. Hahn, E. B. Duoss & S. E. Baker, "Train small, model big: scalable physics simulators via reduced order modeling and domain decomposition," *Computer Methods in Applied Mechanics and Engineering*, **427**, (2024).

S. W. Chung & J. B. Freund, "An optimization method for chaotic turbulent flows," *Journal of Computational Physics*, **457**, (2022).

S. W. Chung, S. D. Bond, E. C. Cyr, & J. B. Freund, "Regular sensitivity computation avoiding chaotic effects in particle-in-cell plasma methods," *Journal of Computational Physics*, **400** (2020).

CONFERENCE TALKS

S. W. Chung, Y. Choi, P. Tranquilli, C. Miller, H. K. Springer & K. Sullivan, "Bayesian Parametric Latent Dynamics Modeling of Shock-Induced Pore Collapse Process," *International Annual Conference of the Fraunhofer ICT* (2025).

S. W. Chung, Y. Choi, P. Tranquilli, C. Miller, H. K. Springer & K. Sullivan, "Gaussian-Process-Based Parametric Latent Dynamics Modeling of Shock-Induced Pore Collapse Process," *SIAM Conference on Computational Science and Engineering* (2025).

S. W. Chung, Y. Choi, P. Roy, T. Roy, T. Moore, T. Lin & S. E. Baker, "Scalable physics-guided data-driven component model reduction for steady Navier-Stokes flow," *NeurIPS 2024 Workshop on the Machine Learning and the Physical Sciences* (2024).

I. Zanardi, A. N. Diaz, S. W. Chung, M. Panesi, & Y. Choi, "Scalable nonlinear manifold reduced order model for dynamical systems," *NeurIPS 2024 Workshop on the Machine Learning and the Physical Sciences* (2024).

D. Chakraborty, **S. W. Chung** & R. Maulik, "Divide and Conquer: Improved Training of Neural Ordinary Differential Equations Through Time-domain Splitting," *SIAM Conference on Mathematics of Data Science* (2024).

S. W. Suh, **S. W. Chung** & Y. Choi, "On-the-fly Dynamic Mode Decomposition," *16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics* (2024).

D. Chakraborty, **S. W. Chung** & R. Maulik, "Divide and Conquer: Improved Training of Neural Ordinary Differential Equations Through Time-domain Splitting," *16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics* (2024).

S. W. Chung, Y. Choi, P. Roy, T. Roy, T. Moore, T. Lin & S. E. Baker, "Train Small, Model Big: Scalable Robust Physics Simulator via Reduced Order Modeling and Domain Decomposition," *16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics* (2024).

S. W. Chung, Y. Choi, P. Roy, T. Roy, T. Moore, T. Lin & S. E. Baker, "Scalable physics-guided data-driven component model reduction for Stokes flow," *NeurIPS 2023 Workshop on the Machine Learning and the Physical Sciences* (2023).

P.-H. Tsai, **S. W. Chung**, D. Ghosh, J. Loffeld, Y. Choi & J. L. Belof, "Accelerating Kinetic Simulations of Electrostatic Plasmas with Reduced-Order Modeling," *NeurIPS 2023 Workshop on the Machine Learning and the Physical Sciences* (2023).

S. W. Suh, **S. W. Chung**, T. Bremer & Y. Choi, "Accelerating Flow Simulations using Online Dynamic Mode Decomposition," *NeurIPS 2023 Workshop on the Machine Learning and the Physical Sciences* (2023).

S. W. Chung & J. B. Freund. "Finding an optimal flow control with multi-point penalty method," *Bulletin of the American Physical Society*, **67** (2022).

S. W. Chung, T. A. Oliver, L. L. Raja & R. D. Moser, "Characterization of uncertainties in electron-argon collision cross sections under statistical principles," *Bulletin of the American Physical Society*, **67** (2022).

S. W. Chung & J. B. Freund. "Multi-point penalty-based optimization for optimal control of chaotic turbulent flow," *Bulletin of the American Physical Society*, **66** (2021).

S. W. Chung & J. B. Freund, "Multi-point augmented Lagrangian optimization for chaotic flows," *SIAM Conference on Computational Science and Engineering*, (2021).

S. W. Chung & J. B. Freund. "Multi-point augmented Lagrangian optimization for chaotic flows," *Bulletin of the American Physical Society*, **65** (2020).

S. W. Chung & J. B. Freund, "Adjoint-based analysis of controllability of turbulent jet noise," *Bulletin of the American Physical Society*, **64** (2019).

S. W. Chung, S. D. Bond, E. C. Cyr, & J. B. Freund, "Regular sensitivity computation avoiding chaotic effects in particle-in-cell plasma methods," *International Conference on Numerical Simulation of Plasmas*, (2019).

S. W. Chung, S. D. Bond, E. C. Cyr, & J. B. Freund, "Sensitivity analysis in particle-in-cell methods," *SIAM Conference on Computational Science and Engineering*, (2019).

S. W. Chung, R. Vishnampet, D. Bodony, & J. B. Freund, "Adjoint-based sensitivity of jet noise to near-nozzle forcing," *Bulletin of the American Physical Society*, **62** (2017).

INVITED TALKS

S. W. Chung, "Overview of data-driven finite element method and its pathway toward foundation model in computational science," *Interdisciplinary Scientific Computing Laboratory Seminar*, Pennsylvania State University, (2025).

S. W. Chung, "Data-driven discontinuous Galerkin FEM via Reduced Order Modeling and Domain Decomposition," *FEM@LLNL Seminar*, Lawrence Livermore National Laboratory, (2024).

J. B. Freund & **S. W. Chung**, "Sensitivity and Optimization within simulations of chaotic flow system," Lawrence Livermore National Laboratory, (2021).

S. W. Chung, "Sensitivity Calculation and Gradient-based Optimization for Chaotic Dynamical Systems," *Fluid Mechanics Seminar*, University of Illinois at Urbana-Champaign, (2020).

S. W. Chung, "Sensitivity Analysis in Particle-in-cell methods," Sandia National Laboratories, (2017).

JOURNAL REFEREE

Journal of Fluid Mechanics (2022-present)
Physics of Fluids (2025-present)

RESEARCH TOOLS DEVELOPED

- **`scaleupROM`: Scalable Physics-guided Reduced Order Model**
  https://github.com/LLNL/scaleupROM
  - A data-driven discontinuous Galerkin FEM for general PDE systems based upon `MFEM` and `libROM`
  - Developed and demonstrated the framework for various physics

- **`pylibROM`: python interface for libROM**
  https://github.com/LLNL/pylibROM
  - Implemented efficient python interface for `libROM` classes
  - Demonstrated examples of DMD and projection-based ROM for various physics systems

- **`libROM`: Library for Reduced Order Models**
  https://www.librom.net/
  - Implemented and maintained Docker container and CI workflow

- **`TPS`: Torch Plasma Simulator**
  with M. Bolinches, T. Oliver, K. Schulz, R. Moser https://github.com/pecos/tps
  - A discontinuous-Galerkin multi-physics application to support a plasma torch prediction, implmented upon a gpu-enabled finite-element library (`MFEM`)
  - Formulated and implmented a two-temperature non-equilibrium reacting flow solver

- **`magudi`: Dual-consistent, Discrete-exact Adjoint solver for Compressible Flows**
  with R. Vishnampet, J. B. Freund https://github.com/dreamer2368/magudi
  - A Fortran-based compressible flow solver, equipped with discrete-exact adjoint-based gradient.
  - Incorporated a Python-based framework for multi-point penalty-based optimization capability.

- **`torch1d`: one-dimensional reduced-model for inductively-coupled plasma torch**
  with T. Oliver, R. Moser https://github.com/pecos/torch1d
  - A Python-based finite-difference solver for a one-dimensional reduced torch model
  - Supports low-Mach limit formulation for two-temperature non-equilibrium plasma

- **`adjoint playground`: Adjoint, penalty-based optimization for chaotic flow controls**
  with J. B. Freund *Available upon request*
  - A MATLAB-based penalty-based optimization framework for various chaotic dynamical systems.
  - Provides a discrete-exact adjoint gradient for semi-implicit Runge-Kutta 4th-order time integrator.

- **`PASS`: Particle Adjoint Sensitivity Sandbox**
  with J. B. Freund https://github.com/dreamer2368/PASS
  - A Fortran-based 1D Particle-in-Cell code for plasma kinetics, with adjoint gradient capability

AWARDS/FELLOWSHIPS

Jeong-Song Fellowship 2014 - 2016
Jeong-Song Cultural Foundation, Korea $110,000

Honor Graduation Award 2014
Seoul National University Ranked 5 of 139 (summa cum laude)

Presidential Science Fellowship 2008 - 2014
M. B. Lee, the President of Republic of Korea $40,000

TEACHING

- **TAM 210/211: Statics** Spring 2020
  Teaching Assistant University of Illinois at Urbana-Champaign
  - Ranked as Excellent in the list of Spring 2020 semester.
  - Conducted discussion sessions (1 time/wk) for 27 students.
  - Prepared in-depth solution procedures.
  - Provided extended office hours: 6 hrs/wk

GRADUATE COURSES

Fluid Mechanics	**Computational Methods**	**Applied Mechanics**
Inviscid Flow	Computational Mechanics	Control System Theory & Design
Viscous Flow	Uncertainty Quantification	Solid Mechanics I
Instability and Transition	Asymptotic Method	Combustion Fundamentals
Turbulence	Mathematical Methods II	Non-Newtonian Fluid Mechanics & Rheology