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** — **January 2023 - Present**
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 two summer student interns (Ping-Hsuan Tsai, Seung-Won Suh)**

◦ **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, Y. Choi, P. Roy, T. Roy, T. Moore, T. Lin & S. E. Baker, "Train small, model big: scalable physics simulators via reduced order modeling and domain decomposition," *In preparation.*

S. W. Chung, T. A. Oliver, L. Raja & R. D. Moser, "Characterization of uncertainties in electron-argon collision cross sections under statistical principles," *Plasma Sources Science and Technology*, submitted, (2023).

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. 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

J. B. Freund & S. W. Chung, Lawrence Livermore National Laboratory, (2021).

S. W. Chung, *Fluid Mechanics Seminar*, University of Illinois at Urbana-Champaign, (2020).

S. W. Chung, Sandia National Laboratories, (2017).

JOURNAL REFEREE

Journal of Fluid Mechanics (2022-present)

RESEARCH TOOLS DEVELOPED

- **`scaleupROM`: Scalable Physics-guided Reduced Order Model**
  `https://github.com/LLNL/scaleupROM`
  - **A scalable reduced order model for linear PDE systems with discontinuous Galerkin domain decomposition, implemented upon `MFEM` and `libROM` framework**
  - **Developed and demonstrated the framework for Poisson and Stokes flow equation**

- **`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**

- **`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**

- **`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.**

- **`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**

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**

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**

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