

SEUNG WHAN CHUNG

Postdoctoral Fellow ◊ Predictive Engineering & Computational Science ◊ University of Texas, Austin
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EDUCATION

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

RESEARCH

- ◊ **University of Texas at Austin** September 2021 - Present
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.

PUBLICATIONS

- S. W. Chung**, T. A. Oliver, L. Raja & R. D. Moser, “Characterization of uncertainties in electron-argon collision cross sections under statistical principles,” *In preparation*.
- S. W. Chung** & J. B. Freund, “Finding an optimal free-space flow control with multi-point penalty method,” *In preparation*.
- 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).

JOURNAL REFEREE

Journal of Fluid Mechanics (2022-present)

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).

CONFERENCE TALKS

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).

RESEARCH TOOLS DEVELOPED

- **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, implemented upon a gpu-enabled finite-element library ([MFEM](#))
- Formulated and implemented 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://bitbucket.org/xpacc-dev/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

Teaching Assistant

Spring 2020

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

Jeong-Song Cultural Foundation, Korea

2014 - 2016

\$110,000

Honor Graduation Award

Seoul National University

2014

Ranked 5 of 139 (summa cum laude)

Presidential Science Fellowship

M. B. Lee, the President of Republic of Korea

2008 - 2014

\$40,000

GRADUATE COURSES

Fluid Mechanics

Inviscid Flow

Viscous Flow

Instability and Transition

Turbulence

Computational Methods

Computational Mechanics

Uncertainty Quantification

Asymptotic Method

Mathematical Methods II

Applied Mechanics

Control System Theory & Design

Solid Mechanics I

Combustion Fundamentals

Non-Newtonian Fluid Mechanics & Rheology

SKILLS

Computer Languages

Parallel Programming

Scripting

Version Control

Documentation

Visualization and I/O

Presentation

Python, C++, MATLAB, Fortran

MPI, CUDA ([MFEM](#))

Python, Bash, Flux

Git, Docker

L^AT_EX, Vi/Vim, Mendeley

PLOT3D, HDF5, Paraview

Beamer, Keynote, Adobe Illustrator/Premiere