

SEUNG WHAN CHUNG

PhD Student ◇ Theoretical and Applied Mechanics ◇ University of Illinois at Urbana-Champaign

(+1) 217 417 1921 ◇ schung58@illinois.edu ◇ chung-research.com ◇ [linkedin](https://www.linkedin.com/in/seungwhanchung)

EDUCATION

University of Illinois at Urbana-Champaign	<i>January 2017 - Expected: August 2021</i>
Ph. D in Theoretical and Applied Mechanics (candidate)	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	GPA: 3.96/4.3

PUBLICATIONS

S. W. Chung & J. B. Freund, “A gradient-based optimization framework for optimal control of chaotic turbulent flows,” *In preparation*.

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 & 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).

RESEARCH TOOLS DEVELOPED

◦ **PASS: Particle Adjoint Sensitivity Sandbox**

with J. B. Freund

<https://github.com/dreamer2368/PASS>

- A Fortran-based 1D Particle-in-Cell – Monte-Carlo-Collision code for plasma kinetics simulations.
- Particle-exact/particle-pdf sensitivity solver

- **magudi: Dual-consistent, Discrete-exact Adjoint solver for Compressible Flows**
with R. Vishnampet, J. B. Freund <https://bitbucket.org/xpacc-dev/magudi/>
 - Created verification cases to ensure discrete-exactness.
 - Developed a Python-based Bash/Flux-script generator for large-scale gradient-based optimization.
 - Incorporated multi-point penalty-based optimization framework for chaotic dynamical systems.
- **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.

RESEARCH

- **Multi-point penalty-based optimization for chaotic flow control**
Graduate researcher *University of Illinois at Urbana-Champaign*
 Advisor: Prof. Jonathan B. Freund *December 2019 - Present*
 - Quantified and analyzed optimization performance degradation in chaotic dynamical systems.
 - Developed multi-point penalty-based optimization framework for non-convex optimization of chaotic flows.
 - Demonstrated the method in various chaotic flow control optimizations, from 1D Kuramoto–Sivashinsky equation to 3D turbulent Kolmogorov flow.
 - In preparation for a publication.
- **Adjoint-based optimization for a supersonic jet noise**
Graduate researcher *University of Illinois at Urbana-Champaign*
 Advisor: Prof. Jonathan B. Freund *May 2017 - December 2019*
 - Implemented a compressible Mach-1.3 jet simulation, using a Fortran-based Navier-Stokes solver with energy-stable high-order finite-difference discretization.
 - Verified turbulence development of the jet
 - Implemented Ffowcs-Williams-Hawkings (FWH) solver to validate sound radiation of the jet
 - Performed the jet noise control optimization using 10^4 CPUs, and quantified optimization performance degradation in the chaotic turbulent jet.
- **Sensitivity algorithm for particle-in-cell (PIC) plasma kinetics**
Graduate researcher *Center for Exascale Simulation of Plasma-Coupled Combustion*
 Advisor: Prof. Jonathan B. Freund *January 2015 - January 2017*
Student intern *Sandia National Laboratories*
 Mentor: Dr. Stephen D. Bond, Dr. Eric C. Cyr *January 2017 - May 2017*
 - Formulated discrete, particle-exact sensitivity in PIC simulation, and demonstrated sensitivity degradation due to chaotic particle dynamics.
 - Participated in a 4-month student internship at Sandia National Laboratories for collaboration.
 - Developed new particle-pdf sensitivity method which avoids the chaotic effect of particle dynamics. Published a peer-reviewed journal paper.
 - Demonstrated the sensitivity algorithm for the sensitivity of Debye shielding response and sheath edge formation.
 - Developed a Fortran-based 2D finite-volume Vlasov solver for validation of the new sensitivity algorithm.

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

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

Fortran, MATLAB, Python

Parallel Programming

MPI

Scripting

Python, Bash, Flux

Compiling

Make, CMake

Documentation

L^AT_EX, Vi/Vim, Mendeley

Visualization and I/O

PLOT3D, Paraview

Presentation

Beamer, Keynote, Adobe Illustrator/Premiere