

# Jea-Hyun Park

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*Visiting Assistant Professor*

## Education

- 2021-07-31 **PhD in Mathematics**, *University of Tennessee Knoxville*, Knoxville, Tennessee USA.  
○ Advisors: Steven M. Wise, Abner J. Salgado.  
○ Thesis: Preconditioned Nesterov's Accelerated Gradient Descent Method and Its Applications to Nonlinear PDE.
- 2014-02-01 **MS in Mathematics Education**, *Korea National University of Education*, Cheongju-si, Chungbuk Korea.  
○ Thesis: A Case-Study on Creative Exploring Activities for Uncomplicated Routine Problems.
- 2007-02-01 **BS in Mathematics Education**, *Kongju National University*, Kongju-si, Chungnam Korea.

## Positions

- 08/2021 - **Visiting Assistant Professor**, *University of California Santa Barbara*, Department of Mathematics.
- 08/2016- **Graduate Teaching and Research Assistant**, *University of Tennessee*  
07/2021 *Knoxville*, Department of Mathematics.
- 08/2010- **High school teacher**, *Chungnam, Korea*, Hapdeok Steel High School.  
02/2012
- 03/2008- **Middle school teacher**, *Chungnam, Korea*, Geunheung Middle School.  
07/2009
- 03/2007- **High school teacher**, *Chungnam, Korea*, Deacheon Women's High School.  
02/2008

## Teaching

- 2023 Fall **Introduction to Numerical Analysis**, *University of California Santa Barbara*, Math 104A.  
○ Main instructor
- 2023 Spring **Vector Calculus 1**, *University of California Santa Barbara*, Math 6A.  
○ Main instructor (150 students)

- 2023 Winter **Vector Calculus 1**, *University of California Santa Barbara*, Math 6A.  
 ○ Main instructor (150 students)
- 2023 Winter **Transition to Higher Mathematics**, *University of California Santa Barbara*, Math 8.  
 ○ Main instructor
- 2022 Fall **Introduction to Numerical Analysis**, *University of California Santa Barbara*, Math 104A.  
 ○ Main instructor (two sections of 65 students)
- 2022 Spring **Calculus 2 (Univariate Integral Calculus)**, *University of California Santa Barbara*, Math 3B.  
 ○ Main instructor
- 2022 Winter **Calculus 2 (Univariate Integral Calculus)**, *University of California Santa Barbara*, Math 3B.  
 ○ Main instructor (150 students)
- 2021 Fall **Linear Algebra**, *University of California Santa Barbara*, Math 4A.  
 ○ Main instructor (150 students)
- 2021 Fall **Calculus 2 (Univariate Integral Calculus)**, *University of California Santa Barbara*, Math 3B.  
 ○ Main instructor (150 students)
- 2021 Spring **Various**, *University Tennessee Knoxville*, Proctor.  
 ○ Online exam proctor for pandemic
- 2020 Fall **Differential Equation 1**, *University Tennessee Knoxville*, Math 231.  
 ○ Teaching assistant (grading, office hours)
- 2020 Spring **Differential Equation 1**, *University Tennessee Knoxville*, Math 231.  
 ○ Teaching assistant (grading, office hours)
- 2019 Fall **Finite Mathematics**, *University Tennessee Knoxville*, Math 123.  
 ○ Recitation leader of a section
- 2019 Spring **Basic Calculus**, *University Tennessee Knoxville*, Math 125.  
 ○ Section leader of a half-flipped course
- 2018 Fall **Differential Equation 1**, *University Tennessee Knoxville*, Math 231.  
 ○ Teaching assistant (grading, office hours)
- 2018 Spring **Basic Calculus**, *University Tennessee Knoxville*, Math 125.  
 ○ Section leader of a half-flipped course
- 2017 Fall **Basic Calculus**, *University Tennessee Knoxville*, Math 125.  
 ○ Section leader of a half-flipped course
- 2017 Spring **Basic Calculus**, *University Tennessee Knoxville*, Math 125.  
 ○ Section leader of a half-flipped course
- 2016 Fall **College Algebra**, *University Tennessee Knoxville*, Math 119.  
 ○ Section leader of a half-flipped course
- 08/2010-02/2012 **10- and 11-th grade Mathematics**, *Hapdeok Steel High School*, Mathematics.  
 ○ High school teacher

- 03/2008- **7-9th grade Mathematics**, *Geunheung Middle School*, Mathematics.  
 07/2009 ○ Middle school teacher
- 03/2007- **11-th grade Mathematics**, *Deacheon Women's High School*, Mathematics 1.  
 02/2008 ○ High school teacher

## Mentoring

- 2023 Fall **First-gen and transfer mentoring**, *Career/Life*, Successful, fulfilling college life and self-conception.  
 ○ Giving transfer/first-generation college students advice and information on how to get involved in research, how to balance work/academic/life, and how to get involved K-12 education program.
- 2023 Summer **REU (self-organized)**, *Undergraduate Research*, Mobility discovery of Cahn-Hilliard equation..  
 ○ Mentor 2 undergraduate scholars
- 2023 Winter-Spring **Directed Reading Program**, *Undergraduate exploratory study mentoring*, Hamiltonian Monte Carlo Method..  
 ○ Mentor 2 undergraduate students for producing a poster about a tool that is used in real world
- 2023 Spring **Wisdom hours**, *Career/Life*, Successful and fulfilling college life and career plan.  
 ○ Weekly walk-in hours for personal discussions
- 2023 Winter **Growth hours**, *Career/Life*, Successful and fulfilling college life and career plan.  
 ○ Weekly walk-in hours for personal discussions
- 2022 Fall **Friendship hours**, *Career/Life*, Successful and fulfilling college life and career plan.  
 ○ Weekly walk-in hours for personal discussions
- 2022 Spring **Small gathering**, *Career/Life*, Successful and fulfilling college life..  
 ○ Monthly gathering with 8 undergraduate students for informal discussions on college life
- 2021 Summer **REU at UCSB**, *Undergraduate Research*, Data-driven dynamic discovery of multi-agent systems.  
 ○ Co-mentor 6 undergraduate scholars

## Research Interests

Optimization.  
 Continuous model for discrete methods.  
 Fast numerical solver for high order, nonlinear PDE.  
 Phase Field Models and Numerical Methods.  
 Inference on PDE and Stochastic Models.  
 Inverse problem.  
 Methods for Bayesian inference (MCMC, HMC, coupling, etc).  
 Mathematical Aspect of Machine Learning and Neural Network.

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## Publications

1. Park, J.-H., Salgado, A. J., & Wise, S. M. (2021). Preconditioned accelerated gradient descent methods for locally Lipschitz smooth objectives with applications to the solution of nonlinear PDEs. *J. Sci. Comput.*, 89(1), Paper No. 17, 37. <https://doi.org/10.1007/s10915-021-01615-8>
2. Park, J.-H., Salgado, A. J., & Wise, S. M. (2023). Benchmark computations of the phase field crystal and functionalized Cahn-Hilliard equations via fully implicit, Nesterov accelerated schemes. *Communications in Computational Physics*, 33(2), 367–398. <https://doi.org/10.4208/cicp.0A-2022-0117>
3. Park, J.-H., Salgado, A. J., & Wise, S. M. (2024). Nondegenerate convergence of the preconditioned gradient descent method for generic local Lipschitz objectives beyond Sobolev embedding. In *progress*.
4. Park, J.-H., Salgado, A. J., & Wise, S. M. (2024). Perturbed preconditioned gradient descent methods for Cahn-Hilliard equation with variable mobility. In *progress*.

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## Talks/Presentations

- 05/19/2024–**SAIM Conference on Mathematical Aspects of Material Science**,  
05/24/2024 *Perturbed Preconditioned Gradient Descent Methods for Stationary Cahn-Hilliard Equation with Variable Mobility (submitted)*, Pittsburgh, PA.  
○ Contributed talk if accepted
- 10/22/2022 **2022 Michigan Council of Teachers of Mathematics (MCTM) Annual Conference**, *Subjective questions through back channels in college math classes*, Michigan (online).  
○ Contributed talk
- 10/07/2022 **Engaging Teaching Symposium**, *Subjective Questions via Clickers for Engagement and Equity*, UC Santa Barbara.  
○ Contributed talk
- 10/02/2021 **6th Annual Meeting of SIAM Central States Section: MiniSymposium-8: Recent Advances in Numerical Methods for Partial Differential Equations**, *Preconditioned Accelerated Gradient Descent Methods for Locally Lipschitz Smooth Objectives with Applications to the Solution of Nonlinear Partial Differential Equations*, University of Kansas (online).  
○ Contributed talk
- 10/01/2021 **PDE/Data Science/Applied Math Semiar**, *Preconditioned Nesterov's acceleration for locally Lipschitz functions and its applications to phase field models*, UC Santa Barbara.  
○ Departmental Seminar talk
- 05/27/2021 **SAIM Conference on Mathematical Aspects of Material Science**, *Stable and Fast Adaptive Solvers for the Functionalized Cahn-Hilliard (FCH) Equation*, Online.  
○ Contributed talk
- 04/05/2021 **Doctoral defense**, *Preconditioned Nesterov's acceleration for locally Lipschitz functions and its applications to phase field models*, Knoxville (online).

- 03/01/2021 **Hong Kong Polytechnic University Numerical Analysis Seminar**, *Numerical Comparison of Some Semi-implicit and Fully Implicit Solvers for Functionalized Cahn-Hilliard and Phase Field Crystal Equations*, Hongkong (online).  
 ○ Invited talk
- 11/11/2020 **Departmental Computational and Applied Mathematics Seminar**, *Numerical approximations of the phase field crystal equation and the functionalized Cahn-Hilliard equation using time-adaptive BDF2 coupled with a preconditioned accelerated gradient descent method.*, University of Tennessee Knoxville.  
 ○ Departmental Seminar talk
- 11/10/2020 **Sayas Numerics Seminar**, *Preconditioned accelerated gradient descent methods for locally Lipschitz smooth objectives with applications to the solution of nonlinear PDEs.*, Online.  
 ○ Contributed talk (this seminar is organized by mathematics departments of several universities to connect researchers of computational mathematics in VA, MD, DC, DE and adjacent areas to provide opportunities to students, postdocs and other early career researchers)
- 10/21/2020 **Southern University of Science and Technology Numerical Seminar**, *Preconditioned accelerated gradient descent methods for locally Lipschitz smooth objectives with applications to the solution of nonlinear PDEs.*, China (online).  
 ○ Invited talk
- 10/16/2020 **Illinois Institute of Technology Numerical Seminar**, *Preconditioned accelerated gradient descent methods for locally Lipschitz smooth objectives with applications to the solution of nonlinear PDEs.*, Illinois (online).  
 ○ Invited talk
- 11/21/2019 **Departmental graduate research showcase**, *A generic picture of research in numerical PDE: modeling, analysis, discrete analysis, and solver development (with the example of Cahn-Hilliard equation)*, University of Tennessee Knoxville.
- 10/02/2019 **Departmental Computational and Applied Mathematics Seminar**, *An ODE model for Nesterov's accelerated gradient descent method for Lipschitz smooth, strongly convex objective functionals.*, University of Tennessee Knoxville.  
 ○ Departmental Seminar talk
- 09/21/2019 **The 43rd Annual Meeting SIAM Southeastern Atlantic Section Minisymposium**, *Preconditioned Nesterov's Accelerated Gradient Descent Method For Strongly Convex, Lipschitz Smooth Objectives.*, University of Tennessee Knoxville.  
 ○ Contributed talk
- 09/11/2019 **Departmental Computational and Applied Mathematics Seminar**, *Nesterov's Acceleration.*, University of Tennessee Knoxville.  
 ○ Departmental Seminar talk
- 01/09/2019 **Oral specialty exam**, *A mixed method for some fourth order elliptic equations related to Cahn-Hilliard equation.* University of Tennessee Knoxville, University of Tennessee Knoxville.

- 02/14/2018 **Departmental Computational and Applied Mathematics Seminar, Discrete Gagliardo-Nirenberg inequality.**, University of Tennessee Knoxville.  
 ○ Departmental Seminar talk
- 12/06/2017 **Departmental Computational and Applied Mathematics Seminar, Finite element approximation of  $p$ -Laplacian.**, University of Tennessee Knoxville.  
 ○ Departmental Seminar talk
- 04/21/2020 **Quantum Computing Class Project Presentation, Berry phase estimation in gate-based adiabatic quantum simulation.**, University of Tennessee Knoxville.  
 ○ Class presentation
- 11/29/2018 **Advanced methods in numerical PDE Class Project Presentation, Interpolation spaces.**, University of Tennessee Knoxville.  
 ○ Class presentation
- 11/28/2017 **Statistics Class Project Presentation, Hamiltonian Monte Carlo – theory and application.**, University of Tennessee Knoxville.  
 ○ Class presentation

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## Conferences/Workshop Attended

- 10/13/2023 **Engaging Teaching Symposium, UC Santa Barbara.**
- 07/24/2023- **MAA OPEN: Redesigning Your Course for Mastery Grading, Online.**  
 07/28/2023 ○ Workshop for redesigning courses so that course outcomes and assessments are aligned
- 10/22/2022 **2022 Michigan Council of Teachers of Mathematics (MCTM) Annual Conference., Michigan (online).**
- 10/07/2022 **Engaging Teaching Symposium, UC Santa Barbara.**
- 07/11/2022- **SIAM Annual Meeting and Joint Conference on Applied Mathematics**  
 07/15/2022 **Education, Online.**
- 10/02/2021- **PDE/Data Science/Applied Math Semiar, UC Santa Barbara.**  
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- 05/17/2021- **The 50th Barrett Lectures: Approximation, Applications, and Analy-**  
 05/19/2021 **sis of Nonlocal, Nonlinear Models, University of Tennessee Knoxville (online).**
- 11/06/2020- **Finite Element Circus, Online.**  
 11/07/2020
- 10/03/2020- **AMS Fall Sectional Meeting (East), Online.**  
 10/04/2020
- 10/02/2020- **University of Washington’s Data-Driven Methods for Science and**  
 12/2020 **Engineering Seminar (bi-weekly), Online.**

- 09/2020- **Sayas Numerics Seminar (weekly)**, *Online*.  
12/2020
- 08/2020- **Springer Nature PDE and Applications Webinar (weekly)**, *Online*.  
10/2020
- 07/06/2020- **SIAM/CAIMS Annual Meeting**, *Online*.  
07/17/2020
- 01/2020- **Quantum Computing Seminar**, *University of Tennessee Knoxville*.  
05/2020
- 11/16/2018 **Householder Lecture**, *University of Tennessee Knoxville*.
- 03/16/2018- **Finite Element Circus**, *University of Tennessee Knoxville*.  
03/17/2018
- 10/25/2017 **Householder Lecture**, *Oak Ridge National Laboratory*.
- 08/2017- **Departmental Computational and Applied Mathematics Seminar**  
05/2021 (weekly, *University of Tennessee Knoxville*).

## Technology/Skills

- Prog C, GPU computing with PyTorch, Matlab (OO), Python (OO)/NumPy/Pandas/Matplotlib.
- Stat SAS/JMP, Matlab with statistics-related toolboxes.
- OS Linux, Mac, Windows.
- Math Mathematica, SageMath, GeoGebra, Mac Grapher.
- Doc LaTeX, R/RStudio, Google documents, Microsoft office, Libre Office.
- Ver Git/Github.
- Teaching WebWork, iClicker, GradeScope, Canvas/Moodle,.

## Service

- 10/2021- **University of California Santa Barbara**, *Departmental Seminar Organizer*.  
06/2023 ○ Managing speaker invitations, announcements, website for the PDE/Applied/Data Science Seminar

## Awards/Scholarships

- 04/11/2019 **Randall E. Cline Award**, *University of Tennessee Knoxville*.  
○ This award was established by friends and colleagues in memory of Dr. Randall E. Cline. It is to provide student aid for scholarly activities associated with graduate student work at The University of Tennessee Department of Mathematics
- 2016-2020 **Chancellor's Fellows**, *University of Tennessee Knoxville*.  
○ The fellowships are available for new graduate students entering the Mathematics PhD program. The fellowship provides additional funding for the first 4 years of the program contingent upon normal progress in the graduate studies and satisfactory performance of assistantship duties

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## Certificates

- 2007 License of Teaching Secondary School Mathematics - 2nd class. Chungnam Office of Education (Korea)
- 2011 License of Teaching Secondary School Mathematics - 1st class (Awarded for teachers with three or more years teaching experience and with a special summer-long training completed). Chungnam Office of Education (Korea)

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## Others

- 2019 Spring **Genetic Algorithm**, *University of Tennessee Knoxville*, Business and Statistics department.
  - I got to learn about genetic algorithm (a quasi-optimizing tool for non-convex functionals that mimics the evolution of living creatures) during a course offered at the Business department in 2019 Spring.
- 2020 Spring **Interest in Quantum Computing**, *University of Tennessee Knoxville*, Physics department, Electric Engineering and Computer Science department.
  - Besides classical computation, I keep an eye on quantum computing, which may provide a breakthrough to our computational capacity. I learned the basics from a course titled quantum information and followed state-of-the-art discussions by attending quantum computing seminar offered by the physics department during the Spring semester 2020 at the University of Tennessee Knoxville
- 2020 Spring **Cryptography coding**, *University of Tennessee Knoxville*, Mathematics department.
  - I learned, coded (using Python and Sage), and enjoyed classical and current coding cryptography techniques such as ElGamal, RSA, and elliptic curve DSA (a technique used for block chains) from an excellent course titled computational number theory, especially in 2020 Spring