

Shinhoo Kang

CONTACT

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Education

- 2014–2019/8 **Ph.D. in Engineering Mechanics.**
Department of Aerospace and Engineering Mechanics
The University of Texas at Austin, TX
Advisor: Tan Bui-Thanh
- 2007–2009 **M.Eng. in Spatial Design and Engineering.**
Handong Global University, Korea
Title: The yellow sand effect on radiowave propagation
Advisor: Cheo K. Lee
- 1999–2007 **B.Eng. in Computer Science and Electrical Engineering.**
Handong Global University, Korea

Research Interests

- o Numerical methods: (Hybridized) Discontinuous Galerkin method, Arbitrary Lagrangian-Eulerian (ALE), Adaptive Mesh-Refinement (AMR), IMplicit-EXplicit (IMEX) method, Multirate/ Exponential Time integrators
- o Computational mechanics: computational fluid dynamics (CFD), geophysical flows (atmospheric flows, mantle convection)
- o High Performance Computing (HPC)
- o Remote sensing

Experience

- 2019.9– present **Postdoctoral Appointee, Argonne National Laboratory, Lemont, IL.**
CANGA project: develop stable coupling methods for multi-physics problem
 - o IMEX/Multirate coupling methods for atmospheric and ocean interaction
 - o Entropy conserving/stable IMEX/Multirate time-stepping methods
- 2021.5 **Attending Workshop, ALCF Computational Performance Workshop, Lemont, IL.**
- 2018.8 **Attending Workshop, Advances in PDEs: Theory, Computation and Application to CFD, Providence, RI.**

- 2017.8 **Attending Workshop**, Argonne Training Program on Extreme-Scale Computing., Lemont, IL.
- 2014–2019.8 **Research Assistant**, The University of Texas, Austin.
- o Develop computational atmospheric modeling in hybridized discontinuous Galerkin (HDG) discretization: implicit-explicit (IMEX) time integrator, spherical advection modeling, and spherical shallow water modeling.
 - o Develop degenerate elliptic equation model with HDG methods
 - o Develop exponential time integrator in the DG discretizations
 - o Develop sliding-mesh interfaces in the (hybridized) DG discretizations
- 2012–2014 **Research Scientist**, Korea Institute of Atmospheric Prediction Systems, Korea.
- Develop and test dynamical core of atmospheric models
- o Parallelize spherical shallow water model/ two-dimensional non-hydrostatic model with MPI in element-based Galerkin (EBG) discretization
 - o Evaluate the shallow water model with ideal test cases
 - o Develop horizontally explicit vertically implicit (HEVI) time integrator on two-dimensional non-hydrostatic model
 - o Compare spurious wave reflection response with staggered finite-volume and unstaggered EBG scheme under mesh-refinement
 - o Examine one-way and two-way grid nesting in EBG discretization
- 2010–2011 **Research Scientist**, National Institute of Meteorological Research, Seoul, Korea.
- Retrieval on remote sensing data and validate the products
- o Improve and validate temperature and moisture retrieval algorithm from ground-based hyperspectral instruments: calculating bias spectrum and obtaining new regression coefficients by using the principal component regression (PCR) method

Computer skills

- Languages JULIA, FORTRAN, C C++, MATLAB, PYTHON, BASH
- Tools Paraview, PETSc

Publications

Journal Papers

Kang, Shinhoo, Alp Dener, Aidan Hamilton, Emil Constantinescu, Hong Zhang, and Robert Jacob, "Multirate Partitioned Runge-Kutta Methods for Coupled Navier-Stokes Equations.", *submitted*, Feb. 2022

Kang, Shinhoo and Emil Constantinescu, "Entropy-Preserving and Entropy-Stable Relaxation IMEX and Multirate Time-Stepping Methods.", *submitted*, Aug. 2021

Kang, Shinhoo and Tan Bui-Thanh, "A Scalable exponential-DG approach for nonlinear conservation laws: with application to Burger and Euler equations.", *Computer Methods in Applied Mechanics and Engineering*, 385, Oct. 2021

Kang, Shinhoo, Emil Constantinescu, Hong Zhang and Rob Jacob, "Mass-Conserving Implicit-Explicit Methods for Coupled Compressible Navier-Stokes Equations.", *Computer Methods in Applied Mechanics and Engineering*, 384, Oct. 2021

Kang, Shinhoo, Tan Bui-Thanh, Todd Arbogast, "A Hybridized Discontinuous Galerkin Method for A Linear Degenerate Elliptic Equation Arising from Two-Phase Mixtures.", *Computer Methods in Applied Mechanics and Engineering*, 350, pp. 315-336, 2019

Kang, Shinhoo, Francis X. Giraldo, Tan Bui-Thanh, "IMEX HDG-DG: a coupled implicit hybridized discontinuous Galerkin (HDG) and explicit discontinuous Galerkin (DG) approach for shallow water systems.", *Journal of Computational Physics*, Oct. 2019

Kang, Shin-Hoo, Tae-Young Goo, and Mi-Lim Ou, "Improvement of AERI T/q Retrievals and Their Validation at Anmyeon-Do, South Korea.", *Journal of Atmospheric and Oceanic Technology*, 30(7), 1433-1446, 2013

Conference Papers

Kang, Shin-Hoo, Tae-Jin Oh, and Hyun Nam, "Comparison of HEVI Time-Stepping methods for Non-hydrostatic equations in continuous Galerkin discretization", *First Half Conference of the Korean Meteorological Society*, 49-50, 2014

Tae-Hyeong Yi, Suk-Jin Choi, Tae-Jin Oh, **Shin-Hoo Kang**, and Ja-Rin Park, "Comparison of Numerical Fluxes for Shallow Water Equations in the discontinuous Galerkin discretization", *First Half Conference of the Korean Meteorological Society*, 286-287, 2013

Oh, Tae-Jin, Tae-Hyeong Yi, Suk-Jin Choi, **Shin-Hoo Kang**, Ja-Rin Park, Young-Joon Kim, "Progress and plans for the dynamical core module development at KIAPS", *First Half Conference of the Korean Meteorological Society*, 12-13, 2013

Kang, Shin-Hoo, Ki-Hwan Kim, Suk-Jin Choi, Jung-Han Kim, Sun-Hee Yun, and Tae-Jin Oh, "Parallelization of KIAPS-SWE based on Continuous and Discontinuous Galerkin Methods", *Second Half Conference of the Korean Meteorological Society*, 504-505, 2013

Kang, Shin-Hoo, Tae-Jin Oh, and Suk-Jin Choi, "Examining One-way and Two-way Grid Nesting in Continuous/Discontinuous Galerkin Discretization", *Second Half Conference of the Korean Meteorological Society*, 476-477, 2012

Lee, Joon-Yong, Yung-Hoon Jo, **Shin-Hoo Kang**, A-Young Kang, Dong-Heon Ha, and Sung-Jun Yoon, "Determination of the existence of LOS blockage and its application to UWB localization.", *Military Communications Conference, 2006*, IEEE, 2006

Jo, Yung-Hoon, Joon-Yong Lee, Dong-Heon Ha, and **Shin-Hoo Kang**, "Accuracy enhancement for UWB indoor positioning using ray tracing.", *The Journal of Korean Institute of Communications and Information Sciences*, 31(10C), 921-926, 2006

Presentations

Oral Presentations

Kang, Shinhoo, Emil Constantinescu, Alp Dener, Hong Zhang and Rob Jacob, "Implicit-Explicit and Multirate methods for a Coupled Navier-Stokes Equations", 2021 American Geophysical Union (AGU) fall meeting (virtual), December 14, 2021

Kang, Shinhoo, Emil Constantinescu, Hong Zhang and Rob Jacob, "Mass-Conserving Implicit-Explicit Methods for Coupled Compressible Navier-Stokes Equations ", the 16th U.S. National Congress on Computational Mechanics (virtual), July 28, 2021

Kang, Shinhoo and Tan Bui-Thanh, "A Scalable exponential-DG approach for nonlinear conservation laws: with application to Burger and Euler equations", 2021 International Conference on Spectral and High Order Methods (virtual), July 13, 2021

Kang, Shinhoo, Emil Constantinescu, "A Relaxed Multirate Integrator for Hyperbolic equations", 2021 International Conference on Spectral and High Order Methods (virtual), July 12, 2021

Kang, Shinhoo, Emil Constantinescu, Hong Zhang and Rob Jacob, "Mass-Conserving Implicit-Explicit Methods for Coupled Compressible Navier-Stokes Equations ", 9th edition of the International Conference on Computational Methods for Coupled Problems in Science and Engineering (virtual), Jun 15, 2021

Kang, Shinhoo, Emil Constantinescu, Hong Zhang and Rob Jacob, "Implicit-Explicit (IMEX) Methods for Coupled Compressible Navier-Stokes Equations", 2021 SIAM Conference on Computational Science and Engineering (virtual), Fort Worth, TX, USA, March 3, 2021

Kang, Shinhoo and Tan Bui-Thanh, "A Scalable exponential-DG approach for nonlinear conservation laws: with application to Burger and Euler equations", Modeling and Simulation of Transport Phenomena (virtual), Moselle, Germany, October 14, 2020

Kang, Shinhoo, Francis X. Giraldo, and Tan Bui-Thanh, "IMEX HDG-DG: a coupled implicit hybridized discontinuous Galerkin and explicit discontinuous Galerkin approach for shallow water systems", North American High-Order Methods Conference, San Diego, CA, USA, June 3, 2019

Kang, Shinhoo, Tan Bui-Thanh and David A. Kopriva, "Discrete Stable, Conservative, and Constant-preserving HDG methods for Hyperbolic Equations on Nonconforming Curved Meshes", Finite Element in Fluid Conference, Chicago, IL, USA, Apr. 3, 2019

Kang, Shinhoo, Tan Bui-Thanh and Todd Arbogast, "Construction and Analysis of HDG Methods for Two-phase Flow", SIAM Conference on Mathematical and Computational Issues in the Geosciences, Houston, TX, USA, Mar. 11, 2019

Kang, Shinhoo and Tan Bui-Thanh, "Toward wind turbine simulation with high-order hybridized discontinuous Galerkin method: IMEX HDG-DG and sliding mesh", SIAM Conference on Computational Science and Engineering, Spokane, Washington, USA, Feb. 27, 2019

Kang, Shinhoo, Sriramkrishnan Muralikrishnan and Tan Bui-Thanh, "IMEX HDG-DG: A coupled implicit hybridized discontinuous Galerkin and explicit discontinuous Galerkin approach for Euler systems", Texas Applied Mathematics and Engineering Symposium, Austin, TX, USA, Sep. 21, 2017

Kang, Shinhoo, Sriramkrishnan Muralikrishnan, Stephen Shannon and Tan Bui-Thanh, "Some advances in the upwind hybridized discontinuous Galerkin method for dynamical cores", The workshop on Partial Differential Equations on the Sphere, Paris, France, Apr. 4, 2017

Kang, Shinhoo, Francis X. Giraldo, and Tan Bui-Thanh, "IMEX-HDG-DG Schemes for Shallow Water Equation", FE RODEO, TAMU, CS, TX, March 4-5, 2016

Kang, Shinhoo, Francis X. Giraldo, and Tan Bui-Thanh, "IMEX-HDG-DG Schemes for Shallow Water Equation", PDE on the sphere, Seoul, Korea, October 27-28, 2015

Kang, Shinhoo, Tan Bui-Thanh, and Francis X. Giraldo, "IMEX-HDG-DG Schemes for Nonlinear Partial Differential Equations", FEM RODEO, SMU, Dallas, TX, February 27-28, 2015

Poster Presentations

Kang, Shinhoo, and Tan Bui-Thanh, "A Hybridized Discontinuous Galerkin method for Geophysical Flows", Advances in PDEs: Theory, Computation and Application to CFD, Providence, RI, USA, Aug. 21, 2018

Kang, Shinhoo, Sriramkrishnan Muralikrishnan, Stephen Shannon, and Tan Bui-Thanh, "An Upwind Hybridized Discontinuous Galerkin Framework", Advances in Mathematics of Finite Elements, Austin, TX, USA, March 22, 2016

Kang, Shin-Hoo, Tae-Jin Oh, and Hyun Nam, "Comparison of HEVI Time-Stepping methods for Non-hydrostatic equations in continuous Galerkin discretization", First Half Conference of the Korean Meteorological Society, Buyeo, Korea, April 21, 2014

Kang, Shin-Hoo, Ki-Hwan Kim, Suk-Jin Choi, Jung-Han Kim, Sun-Hee Yun, and Tae-Jin Oh, "Parallelization of KIAPS-SWE based on Continuous and Discontinuous Galerkin Methods", Second Half Conference of Korean Meteorological Society, Gwangju, Korea, Nov. 2013

Kang, Shin-Hoo and Tae-jin Oh, "Comparison Study of Spurious Wave Reflection Response with Staggered Finite-Volume and Unstaggered Element-Based Galerkin Schemes under Mesh-Refinement", SIAM Conference on the Mathematical and Computational Issues, Padova, Italy, June, 2013

Kang, Shin-Hoo, Tae-Jin Oh, Suk-Jin Choi and Tae-Hyeong Yi, "Examining One-way and Two-way Grid Nesting in Continuous/ Discontinuous Galerkin discretization", The Fall Meeting of AGU, San Francisco, CA, USA, Dec. 2012

Kang, Shin-Hoo, Tae-Jin Oh, and Suk-Jin Choi, "Examining One-way and Two-way Grid Nesting in Continuous/Discontinuous Galerkin Discretization", Second Half Conference of the Korean Meteorological Society, Nov. 2012

Kang, Shin-Hoo, Tae-Young Goo, and Mi-Lim Ou, "Improvement of AERI T/q retrievals", The Autumn Meeting of Korean Meteorological Society Conference, Pusan, Korea, Oct. 2011

References

Dr. Emil M. Constantinescu, Mathematics and Computer Science Division, Argonne National Laboratory, Lemont, IL 60439, USA, emconsta@anl.gov

Prof. Francis X. Giraldo, Dep. of Applied Mathematics, Naval Postgraduate School, Monterey, CA 93940, USA, fxygirald@nps.edu

Prof. Tan Bui-Thanh, Dep. of Aerospace Engineering and Engineering Mechanics, The Oden Institute for Computational Engineering and Sciences, The University of Texas at Austin, Austin, TX 78705, USA, tanbui@oden.utexas.edu

Prof. Todd Arbogast, Dep. of Mathematics, The Oden Institute for Computational Engineering and Sciences, The University of Texas at Austin, Austin, TX 78705, USA, arbogast@oden.utexas.edu