CURRICULUM VITAE
Misun Min

My research focuses on challenging simulation problems governed by PDEs using state of the art high-order methods, which are efficient with respect to data movement and operation count. A major part of my work is directed towards scalability, whether using millions of MPI ranks on Mira or tens of thousands of ranks on GPU platforms (which was initiated for NekCEM and Nek5000 through my efforts to port to OLCF's Titan in 2014). I am the Argonne lead for the ECP Center for Efficient Exascale Discretizations ($6.4M in funding, 2017–2023).

Curriculum Vitae

- Degrees Attained

  2003, Ph.D., Applied Mathematics, Brown University
  1997, M.S., Applied Mathematics, Brown University
  1993/1991, M.S./B.S., Mathematics, Hanyang University, South Korea

- Positions Held

  2011–present, Computational Scientist, Argonne National Laboratory
  2006–2011, Assistant Computational Scientist, Argonne National Laboratory
  2003–2006, Postdoctoral Researcher, Argonne National Laboratory
  2003, Postdoctoral Research Associate, Applied Mathematics, Brown University
  1998–2002, Research Assistant, Applied Mathematics, Brown University
  1997, Teaching Assistant, Applied Mathematics, Brown University
  1994–1996, Researcher, Mobile Communication R&D, Hyundai Electronics, South Korea
  1991–1993 Teaching Assistant, Mathematics, Hanyang University, South Korea

- Honors and Awards

  2021 DOE INCITE Award
  2016 R&D100 Award: Lead PI, NekCEM/Nek5000 Scalable High-Order Simulation Codes
  2016 ALCF Theta Early Science Program (ESP) Award
  2003 The Stella Dafermos Award (Applied Math, Brown University)
  2002 Dissertation Fellowship (Applied Math, Brown University)

- External Funding
  - Role: Argonne PI
  - Title: DOE ECP Co-Design Center for Efficient Exascale Discretizations
  - Status: Awarded
  - Period: 11/18/2016–06/30/2023
  - Funding Amount to Argonne: $6,436,024

  - Role: Co-PI
  - Title: DOE ASCR High-Order High-Performance Multiphysics Simulations
  - Status: Awarded
  - Period: 10/01/2020–09/30/2023
  - Funding Amount to Argonne: $1,500,000

- Role: Co-PI
- Title: DOE ASCR High-Order High-Performance Multiphysics Simulations
- Status: Awarded
- Period: 10/01/2017–09/30/2020
- Funding Amount to Argonne: $1,500,000

- Role: Co-PI
- Title: DOE ASCR High-Order High-Performance Multiphysics Simulations
- Status: Awarded
- Period: 10/01/2014–09/30/2017
- Funding Amount to Argonne: $1,500,000

- Role: Co-PI
- Title: DOE ASCR Transport Simulation beyond Petascale
- Status: Awarded
- Period: 10/01/2011–09/30/2014
- Funding Amount to Argonne: $1,500,000

- Role: Co-PI
- Title: DOE ASCR Petascale Algorithms for Transport Simulation
- Status: Awarded
- Period: 10/01/2009–09/30/2011
- Funding Amount to Argonne: $1,550,000

- Role: Principal Contributor
- Title: NSF Association for Women in Mathematics (AWM) Workshops and Noether Lecture, Mathematical Modeling and High Performance Simulations for Multiphysics and Multiscale Problems
- Status: Awarded
- Period: 08/01/2014–07/31/2015
- Funding Amount: $42,325

- Internal Funding

  - Role: MCS (Mathematics and Computer Science) Lead
  - Title: ANL LDRD Strategic Initiative Next-generation Engine Simulation Code
  - Status: Awarded
  - Period: 10/01/2016–09/30/2017
  - Funding Amount: $720,000

  - Role: PI
  - Title: ANL LDRD Strategic Initiative Extreme-scale Electromagnetic Modeling
  - Status: Awarded
  - Period: 10/01/2012–09/30/2014
  - Funding Amount: $500,000

  - Role: Co-PI
  - Title: ANL LDRD Strategic Initiative New framework for Electromagnetics Code
  - Status: Awarded
  - Period: 10/01/2009–09/30/2011
  - Funding Amount: $600,000

- Professional Activities

(1) Workshop and Meeting Organization

- Organizer, Advanced Simulation Workshop (www.asw2020.org), ANL, Feb. 28, 2020.
- Organizer, DOE ECP CEED Project Kick-Off Meeting, ANL, Jan. 10–12, 2017.

(2) Conference Committee Roles

- SC21 Workshop Program Committee.
- 2020 ATPESC (Argonne Training Program on Extreme-Scale Computing) Program Committee.
- 2020 ISC High Performance Conference PhD Forum Program Committee.
- SC18 Technical Paper Review Panel, Jun. 4–5, 2018.
- SC16 Technical Paper Review Panel, Jun. 6–7, 2016.
- 2015 PhD Selection Committee, AWM–SIAM CSE Workshop.
- 2015 AWM SIAM CSE Workshop Committee.
- 2014 AWM SIAM Annual Meeting Workshop Committee.

(3) Conference Minisymposium Organization

- Minisymposium Organizer for ICOSAHOM21, Vienna, Austria, Jul. 12–16, 2021.
- Minisymposium Organizer for SIAM CSE2021, Fort Worth, Mar. 1–5, 2021.
- Co-Host, CEED Annual Meeting, Aug. 11–12, 2020.
- Co-Organizer, CEED breakout session, ECP Annual Meeting, Houston, Feb. 3–7, 2020.
- Minisymposium Organizer for SIAM CSE2019, Spokane, Feb. 25–Mar. 1, 2019.
- Co-Organizer, CEED breakout session, ECP Annual Meeting, Houston, Jan. 14–17, 2019.
- Co-Organizer, CEED breakout session, ECP Annual Meeting, Knoxville, Feb. 5–9, 2018.
- Minisymposium Organizer for ICOSAHOM18, London, UK, Aug. 29, 2017.
- Co-Organizer, CEED breakout session, ECP Annual Meeting, Knoxville, Jan. 31–Feb. 2, 2017.
- Minisymposium Organizer for AWM-SIAM CSE Workshop, Research Talks by Recent Ph.D.s on Mathematical Modeling and High Performance Computing for Multiscale and Multiphysics Problems, Salt Lake City, Mar. 15, 2015.
- Minisymposium Organizer for SIAM CSE, Salt Lake City, Mar. 14–18, 2015.
- Minisymposium Organizer for AWM-SIAM Workshop, Career Panel: Women and Challenges in Mathematics, Science, and Engineering, Chicago, Jul. 2014.
- Minisymposium Organizer for SIAM CSE, Boston, Feb. 25–Mar. 1, 2013,
- Minisymposium Organizer for SIAM PP, Savannah, Feb. 15–17, 2012.
- Minisymposium Organizer for SIAM CSE, Reno, Feb. 28–Mar. 4, 2011.
- Minisymposium Organizer for ICOSAHOM, Trondheim, Norway, Jun. 22–26, 2009.

(4) Proposal Review

- NSF CFD panel, Washington DC, Mar. 4–6, 2019.
- DOE SBIR (Small Business Innovation Research), Mar. 2015.
- NSF Numerical PDEs panel, Washington DC, Mar. 2012.
- ANL LDRD: Director's Competitive Grants, 2008, 2009, 2010, 2014.
- ANL LDRD: Strategic Initiative on Materials for Energy, 2015.

(5) Journal & Conference Paper Review

- International Journal of High Performance Computing Applications, Journal of Computational Physics, Journal of Scientific Computing, Journal of Computational and Applied Mathematics, Applied Numerical Mathematics, SIAM Journal on Scientific Computing, Proceedings of International Conference on Spectral and High-Order Methods.

(6) External Academic Activities

- Ph.D. Thesis Dissertation Committee, Matthew Christopher (Math/U. Illinois at Chicago), Jun. 2018.
- Ph.D. Thesis Dissertation Committee, Saumil Patel (Mech. Eng./CUNY), Apr. 2016.
- Ph.D. Thesis Committee, Venu Tammali, Math/U. Illinois at Chicago, Apr. 2015.
- Ph.D. Candidate Exam Committee, Saumil Patel, Mech. Eng./CUNY, Sept. 2013.
- Ph.D. Candidate Exam Committee, Kalu Uga, Mech. Eng./CUNY, Aug. 2012.

(7) Other Activities with Meetings and Conferences

- Team Lead, NekRS project, ALCF Aurora Workshop, ANL, Sept. 17–19, 2019.
- Team Lead, Nek/CEED project, OLCF/BNL GPU Hackathon, BNL, Jun. 5–9, 2017.
- Team Lead, NekCEM project, OLCF GPU Hackathon Workshop, UIUC, Apr. 10–23, 2015.
- Team Lead, NekCEM project, OLCF GPU Hackathon Workshop, Knoxville, Oct. 27–31, 2014.
- Participant at numerous project meetings for DOE ECP, CEED, and ASCR Applied Math Research.

(8) ANL Divisional Services: Committee and Organizing Activities

- Laboratory Computing Resource Center (LCRC) Allocation Committee, 2010–present.
- Laboratory for Advanced Numerical Simulations (LANS) Council Committee, 2011–present.
- MCS Wilkinson Fellow Selection Committee, 2012, 2014, 2016, 2018, 2020.
- MCS Postdoc Hiring Committee, 2016–2018.
- Seminar Organizer, LANS Informal Seminar, Dec. 2004–Sept. 2005.
- Minisymposium Co-Chair for Argonne Postdoctoral Symposium, Lemont, IL, Sept. 10, 2009.

- Publications and Presentations

(1) Refereed Journal Articles (* corresponding author)

- Paul Fischer, Stefan Kerkemeier, Misun Min*, Yu-Hsiang Lan, Malachi Phillips, Thilina Rathnayake, Ananias Tomboulides, Ali Karakus, Noel Chalmers, Tim Warburton, NekRS, a GPU-Accelerated Spectral Element Navier–Stokes Solver, Parallel Computing, submitted, 2020. (14 pages)

- Ahmad Abdelfattah, Valeria Barra, Natalie Beams, Ryan Bleile, Jed Brown, Jean-Sylvain Camier, Robert Carson, Noel Chalmers, Veselin Dobrev, Yohann Dudouit, Paul Fischer, Ali Karakus, Stefan Kerkemeier, Tzanio Kolev, Yu-Hsiang Lan, Elia Merzari, Misun Min, Malachi Phillips, Thilina Rathnayake, Robert Rieben, Thomas Stitt, Ananias Tomboulides, Stanimire Tomov, Vladimir Tomov, Arturo Vargas, Tim Warburton, Kenneth Weiss, GPU Algorithms for Efficient Exascale Discretizations, Parallel Computing, submitted, 2020. (14 pages)

- Tzanio Kolev, Paul Fischer, Misun Min, Jack Dongarra, Jed Brown, Veselin Dobrev, Tim Warburton, Stanimire Tomov, Mark S. Shephard, Ahmad Abdelfattah, Valeria Barra, Natalie Beams, Jean-Sylvain Camier, Noel Chalmers, Yohann Dudouit, Ali Karakus, Ian Karlin, Stefan Kerkemeier, Yu-Hsiang Lan, David Medina, Elia Merzari, Aleksandr Obabko, Will Pazner, Thilina Rathnayake, Cameron W. Smith, Lukas Spies, Kasia Swirydowicz, Jeremy Thompson, Ananias Tomboulides, Vladimir Tomov, Efficient Exascale Discretizations, IJHPCA, submitted, 2020. (24 pages)

- Elia Merzari, Haomin Yuan, Misun Min, Dillon Shaver, Ronald Rahaman, Patrick Shriwise, Paul Romano, Alberto Talamo, YuHsiang Lan, Derek Gaston, Richard Martineau, Paul Fischer, Yassin Hassan, CARDINAL: A lower lenth-scale multiphysics simulator for pebble bed reactors, Nuclear Technology, American Nuclear Society, submitted, 2020. (25 pages)

- Paul Fischer, Misun Min*, Thilina Rathnayake, Som Dutta, Tzanio Kolev, Veselin Dobrev, Jean-Sylvain Camier, Martin Kronbichler, Tim Warburton, Kasia Swirydowicz, and Jed Brown, Scalability of high-performance PDE solvers, International Journal of High Performance Computing Applications, in press, 2020. (25 pages)

– Elia Merzari, Paul Fischer, Misun Min, Stefan Kerkemeier, Aleksandr Obabko, Dillon Shaver, Haomin Yuan, Yiqi Yu, Javier Martinez, Landon Brockmeyer, Lambert Fick, Giacomo Busco, Alper Yildiz, and Yassin Hassand, Toward exascale: Overview of large eddy simulations and direct numerical simulations of nuclear reactor flows with the spectral element method in Nek5000, Nuclear Technology, in press, 2020. (17 pages)

– Javier Martinez, Yu-Hsiang Lan, Elia Merzari, and Misun Min, On the use of LES-based turbulent thermal-stress models for rod bundle simulations, International Journal of Heat and Mass Transfer, 142, 118399, 2019. (40 pages)

– Saumil Patel, Paul Fischer, Misun Min, and Ananias Tomboulides, A characteristic-based spectral element method for moving-domain problems, Journal of Scientific Computing, 79, pp. 564–592, 2019. (35 pages)

– Evelyn Otero, Jing Gong, Misun Min, Paul Fischer, Phillip Schlatter, and Erwin Laure, OpenACC acceleration for the PnPn-2 algorithm in Nek5000, Journal of Parallel and Distributed Computing, 132, pp. 69–78, 2019. (10 pages)

– Youngjoon Hong, Matthew Otten, Misun Min, Stephen Gray and David Nicholls, Periodic corrugations to increase efficiency of thermophotovoltaic emitting structures, Applied Physics Letters, 114, No. 5, 051101, 2019. (5 pages)

– Josh Wilson, Fadil Santosa, Misun Min, and Tony Low, Temporal control of graphene plasmons, Physics Review B, 98, 081411, 2018. (8 pages)

– Jing Gong, Stefano Markidis, Erwin Laure, Matt Otten, Paul Fischer, Misun Min*, Nekbone performance on GPUs with OpenACC and CUDA Fortran implementations, Special issue on Sustainability on Ultrascale Computing Systems and Applications: Journal of Supercomputing, 72, No. 11, pp. 4160–4180, 2016. (23 pages)

– Matt Otten, Jeffrey Larson, Misun Min, Stefan M. Wild, Matt Pelton, and Stephen K. Gray, The origins and optimization of entanglement in plasmonically-coupled quantum dots, Physical Review A, 94, 022312, 2016. (34 pages)

– Matt Otten, Jing Gong, Azamat Mametjanov, Aaron Vose, Paul Fischer, and Misun Min*, Hybrid MPI/OpenACC implementation for a high order electromagnetic solver on GPUDirect communication, International Journal of High Performance Computing Applications, 30, No. 3, pp. 320–334, 2016. (13 pages)

– Ying He, Misun Min*, David Nicholls, A high-order spectral element method with transparent boundary conditions for quasi-periodic Helmholtz solutions on rough structures, Journal of Scientific Computing, 68, No. 2, pp. 772–802, 2016. (34 pages)

– Saumil Patel, Misun Min, and Taeun Lee, A spectral element discontinuous Galerkin thermal lattice Boltzmann method for conjugate heat transfer applications, International Journal for Numerical Methods in Fluids, 82, No. 12, pp. 932–952, 2016. (21 pages)

– Matt Otten, Raman A. Shah, Norbert F. Scherer, Misun Min, Matt Pelton, and Stephen K. Gray, Entanglement in hybrid quantum dot/plasmonic systems with two, three and four quantum dots, Physical Review B, 92, 125432, 2015. (13 pages)

– Saumil Patel, Misun Min, Kalu Chibueze Uga, and Taehun Lee, A spectral-element discontinuous Galerkin lattice Boltzmann method for simulating natural convection heat transfer in a horizontal concentric annulus, Computers & Fluids, 95, pp. 197–209, 2014. (13 pages)

– Misun Min* and Paul Fischer, An efficient high-order time integration method for spectral-element discontinuous Galerkin simulations in electromagnetics, Journal of Scientific Computing, 57, pp. 582-–603, 2013. (22 pages)

- Kalu Uga, Misun Min, Taehun Lee, and Paul Fischer, Spectral-element discontinuous Galerkin lattice Boltzmann simulation of flow past two cylinders in tandem with an exponential time integrator, Computers & Mathematics with Applications, 65, No. 2, pp. 239-–251, 2013. Special Issue on Mesoscopic Methods in Engineering and Science (ICMMES-2010, Edmonton, Canada). (13 pages)

- Misun Min and Taehun Lee, Spectral element discontinuous Galerkin lattice Boltzmann method for nearly incompressible flows, Journal of Computational Physics, 230, pp. 245–259, 2011. (16 pages) (**Top 25 Hottest Articles, Rank 17 : Oct-Dec 2010**)

- Misun Min*, Sidi M. Kaber, and Wai-Sun Don, Fourier-Padé rational approximations and filtering for the spectral simulations of incompressible inviscid Boussinesq convection flows, Mathematics of Computation, 76, pp. 1275–1290, 2007. (16 pages)

- Misun Min*, Tae-Woo Lee, Paul Fischer, and Stephen K. Gray, Fourier spectral simulations and Gegenbauer reconstructions for electromagnetic waves in the presence of a metal nanoparticle, Journal of Computational Physics, 213 (2), pp. 730–747, 2006. (18 pages)

- Misun Min* and D. Gottlieb, Domain decomposition spectral approximations for an eigenvalue problem with a piecewise constant coefficient, SIAM Journal on Numerical Analysis, pp. 502–520, 2005. (19 pages)

- Misun Min* and David Gottlieb, On the convergence of the Fourier approximation for eigenvalues and eigenfunctions of discontinuous problems, SIAM Journal on Numerical Analysis, 40, pp. 2254–2269, 2003. (16 pages)

- Misun Min* and Chun-Hao Teng, The instability of the Yee scheme for the "magic time step," Journal of Computational Physics, 166, pp. 418–424, 2001. (7 pages)

(2) Refereed Proceedings (* corresponding author)

- Paul Fischer, Stefan Kerkemeier, Yu-Hsiang Lan, Misun Min, and Elia Merzari, NekRS: Massively parallel fluid flow simulations in reactor cores, 2020 American Nuclear Society Winter Meeting, submitted, 2020. (4 pages)

- Ken Raffenetti, Abdelhalim Amer, Lena Oden, Charles Archer, Wesley Bland, Hajime Fujita, Yanfei Guo, Tomislav Janjusic, Dmitry Durnov, Michael Blocksome, Min Si, Sangmin Seo, Akhil Langer, Gengbin Zheng, Masamichi Takagi, Paul Coffman, Jithin Jose, Sayantan Sur, Alexander Sannikov, Sergey Oblomov, Michael Chuvelev, Masayuki Hatanaka, Xin Zhao, Paul Fischer, Thilina Rathnayake, Matt Otten, Misun Min, and Pavan Balaji, Why is MPI so slow? Analyzing the fundamental limits in implementing MPI-3.1, in SC'17 Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis, No. 62, 2017. (12 pages)

- Paul Fischer, Katie Heisey, and Misun Min, Scaling limits for PDE-based simulation, (invited paper) in AIAA 2015 Aviation, Dallas, TX, 2015. (10 pages)

- Jing Fu, Misun Min, Robert Latham, and Christopher Carothers, I/O threads to reduce checkpoint blocking for an electromagnetics solver on Blue Gene/P and Cray XK6, in the International Workshop on Runtime and Operating Systems for Supercomputers, ICS, 2012. (9 pages)

- Jing Fu, Misun Min, Robert Latham, and Christopher Carothers, Parallel I/O performance for application-level checkpointing on the Blue Gene/P system, in CLUSTER'11, Proceedings of the 2011 IEEE International Conference on Cluster Computing, pp. 465-473, 2011. (10 pages)

(3) Other Proceedings (* corresponding author)

- Jing Gong, Stefano Markidis, Michael Schliephake, Erwin Laure, Luis Cebamanos, Alistair Hart, Misun Min, and Paul Fischer, Nekbone with optimized OpenACC directives, in Second NESUS (Network for Sustainable Ultrascale Computing) Workshop, Vol. I, No. 1, Sept 2015.

- Misun Min*, Jing Fu, and Azamat Mametjanov, Hybrid programming and performance for beam propagation modeling, in Proceedings of International Computational Accelerator Physics (ICAP), FRSAC1, 2012.
- Jin Xu, Xiaohe Zhufu, Ruifeng Zhao, Chao Li, Lei Yang, and Misun Min, Comparisons of different electromagnetic solvers for accelerator simulations, in Proceedings of 11th International Computational Accelerator Physics Conference (ICAP) 2012, WEP08, 2012.
- Misun Min*and Paul F. Fischer, Scalable high-order algorithms for wakefield simulations, in Proceedings of IPAC'10, TUPEC061, 2010.
- Misun Min*and Paul Fischer, Spectral element discontinuous Galerkin (SEDG) simulations with a moving window algorithm for wakefield calculations, in Proceedings of Particle Accelerator Conference, 'TH5PFP037, 2009.
- Misun Min*, Jason Montgomery, Paul Fischer, and Stephen K. Gray, Large-scale electromagnetic modelings based on high-order methods: nanoscience applications, in Journal of Physics: Conference Series, 180, 012016, 2009.
- Misun Min*, Paul Fischer, and Yong-Chul Chae, Wakefields for TESLA cavity structures: Spectral element discontinuous Galerkin simulations, in RF Superconductivity, TUP34, 2007.
- Misun Min*, Paul Fischer, and Yong-Chul Chae, Spectral element discontinuous Galerkin simulations for wakepotential calculations, in Proceedings of Particle Accelerator Conference, pp. 3435–3437, 2007.
- Misun Min*, Yong-Ho Chin, Paul Fischer, Yong-Chul Chae, and Kwang-Je Kim, Fourier spectral simulations for wake fields in conducting cavities, Proceedings of in Particle Accelerator Conference (PAC), pp. 3432–3434, 2007.
- Misun Min*, Quan-Yong Chen, and Yvon Maday, Spectral method for 2D photonic band structures, in Proceedings of SPIE, Photonic Crystal Materials and Device II, Vol. 5360, pp. 44–51, 2004.
- Misun Min*, Discontinuous Galerkin method based on quadrilateral mesh for Maxwell's equations, in Proceedings of ACES/IEEE on Wireless Communications and Applied Computational Electromagnetics, pp. 719–723, 2005.
- Misun Min*, Quan-Yong Chen, and Yvon Maday, Spectral method for 2D photonic band structures, in Proceedings of SPIE, Photonic Crystal Materials and Device II, Vol. 5360, pp. 44–51, 2004.

(4) Selected Technical Reports (* lead author)

- CEED ECP Milestone Report: Initial Integration of CEED Software in ECP/CEED Applications, Misun Min*, Jed Brown, Veselin Dobrev, Paul Fischer, Tzanio Kolev, David Medina, Elia Merzari, Aleks Obabko, Scott Parker, Ron Rahaman, Stanimire Tomov, Vladimir Tomov and Tim Warburton, WBS 1.2.5.3.04, Milestone CEED-MS8, Sept. 2017. (50 pages)
- CEED ECP Milestone Report: Engage second wave ECP/CEED applications, Misun Min*, Jean-Sylvain Camier, Paul Fischer, Ali Karakus, Stefan Kerkemeier, Tzanio Kolev, YuHsiang Lan, David Medina, Elia Merzari, Aleks Obabko, Thilina Ratnayaka, Shaver Dillon, Ananais Tomboulides, Vladimir Tomov, and Tim Warburton, WBS 2.2.6.06, Milestone CEED-MS23, Dec. 2019. (27 pages)
- ANL NEAMS DOE Report: Nek5000 enhancements for faster running analysis, Misun Min*, Ananias Tomboulides, Paul Fischer, Elia Merzari, Dillon Shaver, Javier Martinez, Haomin Yuan, and YuHsiang Lan, ANL.MCS-TM-384, Sept. 2019. (17 pages)
- CEED ECP Milestone Report: Engage First wave ECP/CEED Applications, Misun Min*, Paul Fischer, Vladimir Tomov, Robert Rieben, and Tzanio Kolev, WBS 1.2.5.3.04, Milestone CEED-MS1, Mar. 2017. (16 pages)

- ANL NEAMS DOE Report: An Update on Cardinal: Toward Full Core Pebble Simulations, Elia Merzari, Derek Gaston, Ronald Rahaman, Patrick Schriwise, Yu-Hsiang Lan, Misun Min, Haomin Yuan, ANL/NSE-20/46, 2020.

- CEED ECP Milestone Report: Support CEED-enabled ECP applications in their preparation for Aurora/Frontier, Tzanio Kolev, Paul Fischer Ahmad Abdelfattah, Valeria Barra, Natalie Beams, Jed Brown, Jean-Sylvain Camier, Noel Chalmers, Veselin Dobrev, Stefan Kerkemeier, Yu-Hsiang Lan, Misun Min, Malachi Phillips, Thilina Ratnayaka, Kris Rowe, Jeremy Thompson, Ananias Tomboulides, Stanimire Tomov, Vladimir Tomov, and Tim Warburton, submitted, WBS 2.2.6.06, Milestone CEED-MS35, Sept.30, 2020 (47 pages, full version including NDA section)

- DOE ECP ExaSMR Milestone Report: Initial full core SMR simulations with NekRS, Elia Merzari, Jun Fang, Dillon Shaver, Yu-Hsiang Lan, Misun Min, Paul Fischer, Ronald Rahaman, and et. al., ANL-20/72, Oct. 1, 2020. (25 pages)

- ANL NEAMS DOE report, Nek5000 developments in support of industry and the NRC, Dillon Shaver, Aleks Obabko, Ananias Tomboulides, Victor Coppo Leite, Yu-Hsiang Lan, Misun Min, Paul Fischer and Christopher Boyd, ANL/NSE-20/48, Sept. 30, 2020. (35 pages)

- CEED ECP Milestone Report: Improve performance and capabilities of CEED-enabled ECP applications on Summit/Sierra, Tzanio Kolev, Paul Fischer, Ahmad Abdelfattah, Shreyas Ananthan, Valeria Barra, Natalie Beams, Ryan Bleile, Jed Brown, Robert Carson, Jean-Sylvain Camier, Matthew Churchfield, Veselin Dobrev, Jack Dongarra, Yohann Dudouit, Ali Karakus, Stefan Kerkemeier, YuHsiang Lan, David Medina, Elia Merzari, Misun Min, Scott Parker, Thilina Ratnayaka, Cameron Smith, Michael Sprague, Thomas Stitt, Jeremy Thompson, Ananias Tomboulides, Stanimire Tomov, Vladimir Tomov, Arturo Vargas, Tim Warburton, and Kenneth Weiss, WBS 2.2.6.06, Milestone CEED-MS34, Mar. 2020. (52 pages)

- CEED ECP Milestone Report: Performance tuning of CEED software and 1st and 2nd wave apps, Stanimire Tomov, Ahmad Abdelfattah, Valeria Barra, Natalie Beams, Jed Brown, Jean-Sylvain Camier, Veselin Dobrev, Jack Dongarra, Yohann Dudouit, Paul Fischer, Ali Karakus, Stefan Kerkemeier, Tzanio Kolev, YuHsiang Lan, Elia Merzari, Misun Min, Aleks Obabko, Scott Parker, Thilina Ratnayaka, Jeremy Thompson, Ananias Tomboulides, Vladimir Tomov, and Tim Warburton, WBS 2.2.6.06, Milestone CEED-MS32, Sept. 2019. (32 pages)

- CEED ECP Milestone Report: Improved Support for Parallel Adaptive Simulation in CEED, Mark Shephard, Valeria Barra, Jed Brown, Jean-Sylvain Camier, Yohann Dudouit, Paul Fischer, Tzanio Kolev, David Medina, Misun Min, Cameron Smith, Morteza H. Siboni, Jeremy Thompson, and Tim Warburton, WBS 2.2.6.06, Milestone CEED-MS29, Jun. 2019. (44 pages)

- CEED ECP Milestone Report: Public release of CEED 2.0, Jed Brown, Ahmad Abdelfattah, Valeria Barra, Veselin Dobrev, Yohann Dudouit, Paul Fischer, Tzanio Kolev, David Medina, Misun Min, Thilina Ratnayaka, Smith Cameron, Jeremy Thompson, Stanimire Tomov, Vladimir Tomov, and Tim Warburton, WBS 2.2.6.06, Milestone CEED-MS25, Mar. 2019. (30 pages)

- CEED ECP Milestone Report: Performance tuning of CEED software and first wave apps, Stanimire Tomov, Pedro Bello-Maldonado, Jed Brown, Jean-Sylvain Camier, Veselin Dobrev, Jack Dongarra, Paul Fischer, Azzam Haidar, Tzanio Kolev, Elia Merzari, Misun Min, Aleks Obabko, Scott Parker, Thilina Ratnayaka, Jeremy Thompson, Ahmad Abdelfattah, Vladimir Tomov, and Tim Warburton, WBS 2.2.6.06, Milestone CEED-MS20, Sept. 2018. (41 pages)

- CEED ECP Milestone Report: Propose high-order mesh/data format, Jed Brown, Veselin Dobrev, Som Dutta, Paul Fischer, Kamran Kazem, Tzanio Kolev, David Medina, Misun Min, Thilina Ratnayaka, Mark Shephard, Smith Cameron, and Jeremy Thompson, WBS 2.2.6.06, Milestone CEED-MS18, Jun. 2018. (41 pages)

- CEED ECP Milestone Report: Public release of CEED 1.0, Jed Brown, Ahmad Abdelfata, Jean-Sylvain Camier, Veselin Dobrev, Jack Dongarra, Paul Fischer, Aaron Fisher, Yohann Dudouit,

Azzam Haidar, Kazem Kamran, Tzanio Kolev, Misun Min, Thilina Ratnayaka, Mark Shephard, Smith Cameron, Stanimire Tomov, Vladimir Tomov and Tim Warburton, WBS 2.2.6.06, Milestone CEED-MS13, Mar. 2018. (40 pages)

- CEED ECP Milestone Report: Identify initial kernels, bake-off benchmark problems and miniapps, Veselin Dobrev, Jack Dongarra, Jed Brown, Paul Fischer, Azzam Haider, Ian Karlin, Tzanio Kolev, Misun Min; Tim Warburton, Thilina Ratnayaka, Stanimire Tomov, and Vladimir Tomov, WBS 1.2.5.3.04, Milestone CEED-MS6, Jun. 2017. (32 pages)
- DOE ECP ExaSMR Milestone Report: CFD SMR assembly performance baselines with Nek5000, Elia Merzari, Ron Rahaman, Saumil Patel, Misun Min; Dillon Shaver, Paul Fischer, and Andrew Siegel, WBS 1.2.1.08, Milestone ECP-SE-08-47, Sept. 2017. (24 pages)
- The ALCF Theta Early Science Program Project Report: Flow, Mixing and Combustion of Transient Turbulent Gaseous Jets in Confined Cylindrical Geometries, Christos Frouzakis, George Giannakopoulos, Mahmoud Jafargholi, Stefan Kerkemeier, Misun Min, Ananias Tomboulides, Paul Fischer, and Scott Parker, ANL/ALCF/ESP-17/4, Setp. 2017. (8 pages)
- An Operator-Integration-Faavtor Splitting (OIFS) Method for Inccompressible Flows in Moving Domains, Saumil Patel, Paul Fischer, Misun Min, Ananias Tomboulides, ANL/ALCF-17/8, Oct. 2017.

(5) Media and Other Research Coverage

- NekCEM in book, *Programming for Hybrid Multi/Manycore MPP Systems*, by John Levesque and Aaron Vose, (2017), Chapman and Hall / CRC. Computational Science Series, ISBN 9781439873717, Taylor & Francis.
- NekCEM in the article of The Challenge of Coding across HPC Architectures, nextplatform.com, June 13, 2016.
  http://www.nextplatform.com/2016/06/13/challenge-coding-across-hpc-architectures/
- NekCEM in the article OpenACC Adds Support for OpenPOWER; Touts Growing Traction, hpcwire.com, June 13, 2016.
  https://www.hpcwire.com/2016/06/13/openacc-adds-support-openpower-touts-growing-traction/
- Nvidia technical blog: NekCEM team's effort on Porting Scientific Applications to GPUs at the OLCF OpenACC Hackathon, April 2015.
  https://devblogs.nvidia.com/parallelforall/porting-scientific-applications-gpus-olcf-openacc-hackathon
- PGI website/handout for conferences and trade shows, 2015:
  NekCEM team's successful story with OpenACC.

(6) Invited Talks

- "High-order multiphysics simulations and performance," ICOSAHOM21 Minisymposium on Exascale Applications with High-Order PDE Solvers, Vienna, Austria, Jul. 12–16, 2021.
- "High-order high-performance electromagnetic simulations," ICOSAHOM21 Minisymposium on High-Order Spectral Methods for Plasmonics and Optics, Vienna, Austria, Jul. 12–16, 2021.
- "Implicit solvers for high-order methods," WCCM ECCOMAS 2020 Minisymposium on Advances in High-Order Methods for Computational Fluid Dynamics, Paris, France, Jul. 19–24, 2020 (postponed).
- "Exascale overview & drift diffuion," Nek5000 Users Meeting at KTH Royal Institute of TEchnology, Stockholm, Sweden, Apr. 21–23, 2020 (postponed).
- "CEED Application Overview", The 4th CEED Annual Meeting, Virtual Online, Aug. 11–13, 2020.

– **Plenary Talk**, "Exascale applications of high-order methods," NahomCON19 (The North American High Order Methods Conference), San Diego, Jun. 2–5, 2019.

– "CEED application Overview," The 3rd CEED Annual Meeting, Aug. 7–9, 2019.

– "Nek5000 recent developments," NEAMS RPL (Reactor Product Line) Review Meeting, Nuclear Science & Engineering Division, Argonne National Laboratory, Aug. 14–15, 2019.

– "High-order steady solvers for multiphysics applications", SIAM CSE2019, Spokane, Feb. 25–Mar. 1, 2019

– "High-order methods for high performance multiphysics simulations & Center for Efficient Exascale Discretizations," ANL/MCS All-Hands-Meeting, ANL, Dec. 10, 2018.

– "Steady state Navier-Stokes for spectral element method," ICERM's topical workshop: Advances in PDEs: Theory, Computation and Application to CFD, ICERM, Brown University, Providence, Aug. 20–24, 2018.

– "CEED application thrusts activities," The 2nd CEED Annual Meeting, ECP Co-Design Center for Efficient Exascale Discretizations, Boulder, Aug. 8–10, 2018.

– "Recent advances in high-order simulations for metamaterials," ICOSAHOM18 Minisymposium on Computational Electromagnetics: Diverse Approaches to High-Order Methods, Imperial College, London, UK, Jul. 12, 2018.

– "Jacobian-free Newton Krylov method for solving nonlinear PDEs," ICOSAHOM18 Minisymposium on Radial Basis Function and WENO Methods for Discontinuous Problems, Imperial College, London, UK, Jul. 9, 2018.

– "Ion channel modeling with protein structure data using spectral element methods," ICOSAHOM18 Minisymposium on High Order Numerical Methods and Data Analysis, Imperial College, London, UK, Jul. 10, 2018.

– "Recent advances in high-order simulations for metamaterials," ICERM's topical workshop: Computational Aspects of Time Dependent Electromagnetic Wave Problems in Complex Materials, ICERM, Brown University, Providence, Jun. 25–29, 2018.

– **Panel**, "Panel Discussion," ICERM's topical workshop: Computational Aspects of Time Dependent Electromagnetic Wave Problems in Complex Materials, ICERM, Brown University, Providence, Jun. 25–29, 2018.

– "Drift diffusion," The 6th Nek5000 Users Meeting, University of Florida, Tampa, Apr. 17–18, 2018.

– "High-order spectral element methods for drift-diffusion and electromagnetic systems," Special Session on High Order Numerical Methods for Hyperbolic PDEs and Applications, AMS Sectional Meeting, Buffalo, Sept. 16, 2017.

– "Spectral element simulation for nanowire solar cells on HPC platforms," Minisymposium on Numerical Simulation of Optical and Plasmonic Phenomena, SIAM CSE, Atlanta, Feb. 28, 2017.

– "CEED project overview," ECP Town-Hall Meeting, ANL, Jan. 24, 1017.

– "CEED application overview," CEED Annual Meeting, LLNL, Aug. 15, 2017.

– "NekCEM, drift-diffusion, GPUs, gather-scatter library," The 5th Nek5000 Users Meeting, MIT, Cambridge, Aug. 10–11, 2016.

– "Scalable high-order algorithms for large-scale electromagnetic systems," SIAM Annual Meeting, Boston, Jul. 11–16, 2016.

– "Scalable spectral element discretizations for transport simulations," Minisymposium on High-Order Numerical Methods for solving PDE with Discontinuous Solutions and Its Applications, Rio de Janeiro, Brazil, Jun. 27-Jul. 1, 2016.

– "Scalable high-order simulations for transport equations," The Mathematics of Finite Elements and Applications (MAFELAP) Conference, Brunel University, Uxbridge, UK, Jun. 14–17, 2016.

– "Highly tuned hybrid MPI/OpenACC implementation with GPUDirect communication for electromagnetic and fluid solvers based on high order spectral element discretization," The International Council for Industrial and Applied Mathematics (ICIAM), Beijing, China, Aug. 14, 2015.

– "High-order methods for high-performance simulations", ICIAM, China, Aug. 13, 2015.

– "Scalable algorithms for large scale quantum-mechanical density matrix calculations for a nanoparticle system interacting with multi-state multiple quantum dots," ICIAM, China, Aug. 11, 2015.

– **A 3-day Short Course**, "High-order methods for partial differential equations," National Taiwan University, Taipei, Taiwan, Aug. 19 & Aug. 24–25, 2015.

– "Highly tuned MPI/OpenACC implementation and performance analysis," Nek5000 Users' Meeting, ANL, Jul. 14, 2015.

– "Hybrid MPI/OpenACC implimentation for a high-order electromagnetics solver on GPUDirect communication," Porting Apps to Titan: Results from the Inaugural GPU Hackathon at GPU Technology Conference, San Jose, Mar. 17–20, 2015.

– "Highly tuned hybrid MPI/OpenACC implementation with GPUDirect communication for electromagnetic solvers based on spectral element discretization," SIAM CSE, Salt Lake City, Mar. 14, 2015.

– "NekCEM: Recent developments for electromagnetic systems including driftdiffusion and quantum models," Nek5000 Users' Meeting, Thessaloniki, Greece, Aug. 21, 2014.

– "Hydraulic modeling for quantum absorption calculation in plasmonics based on high-order spectral element discontinuous Galerkin approach," SIAM Annual Meeting, Chicago, Jul. 9, 2014.

– "Exponential time integration methods for wave-dominated problems," International Conference: AMMCS- 2013, Waterloo, Canada, Aug. 26—30, 2013.

– "High-order DG Methods: Scalable algorithms and performance for electromagnetics applications," FEMTEC 2013z; The 4th International Congress on Computational Engineering and Sciences, Las Vegas, May 19–24, 2013.

– "Scalable electromagnetic solver for applications in nanoscale materials," SIAM Conference on Computational Science and Engineering, Boston, Feb. 25–Mar. 1, 2013.

– "Parallel I/O optimizations for a massively parallel electromagnetic system," SIAM Conference on Computational Science and Engineering, Boston, Feb. 25–Mar. 1, 2013.

– "Recent developments in NekCEM/NekLBM codes for electromagnetics and fluids," The 2nd Nek5000 Users' Meeting, Zurich, Switzerland, Dec. 8–9, 2012.

– "Hybrid programming and performance for beam propagation modeling," The 11th International Computatinal Accelerator Physcis Conference, Rostock-Warnemünde, Germany, Aug. 19–24, 2012.

– "Efficient high-order timestepping scheme for transport simulations," Minisympoium on Computational Methods for Hyperbolic Problems at the Laurier Centennial Conference: AMMCS-2011, Waterloo, Canada, Jul. 25–29, 2011.

– "High-performance high-order algorithms for electromagnetics and fluids," Meeting with UIC SIAM students, ANL, Mar. 14, 2011.

– "Performance analysis on the IBM BG/P for high-order electromagnetic modeling," at Minisymposium on Large-Scale Computing for Scientific Applications, SIAM Conference on Computational Science and Engineering, Reno, Nevada, Feb. 28–Mar. 4, 2011.

– "NekCEM: Performance and scalability for electromagnetic modeling," The first Nek5000 Users' Meeting, ANL, Dec. 10, 2010.

– "Towards extreme-scale: high-order algorithms for electromagnetic and fluid modeling," Advanced Scientific Computing Advisory Committee (ASCAC) meeting, ANL, Nov. 10, 2010.

– "High-performance high-order electromagnetic modeling," Special Session on Computational Electromagnetic and Acoustics at the AMS Central Sectional Meeting, Notre Dame, Nov. 5–7, 2010.

– "Spectral element discontinuous Galerkin simulations with moving window for wakefield calculations," International Computational Accelerator Physics (ICAP) Conference, San Francisco, Aug. 31–Sept. 4, 2009.

– "High-order methods in space and time for time-dependent electromagnetic problems," Computational Science and Engineering MiniWorkshop, Yonsei Univerisity, Seoul, Korea, Dec. 18, 2009.

– "Large scale simulations based on spectral-element discontinuous Galerkin methods: Nanoscience and accelerator applications," The First Joint Meeting of KMS and AMS, Computational Science and Engineering Session, Seoul, Korea, Dec. 16–20, 2009.

– "High-performance electromagnetic modeling: Scientific applications in nanoscience and accelerator physics," UKC Conference 2009, Raleigh, Jul. 16–19, 2009.

– "Light transmission calculations for nano arrays: spectral element discontinuous Galerkin method," Minisymposium on Computational Electromagnetics: Theory and Applications for High Order Methods, Trondheim, Norway, Jun. 22–26, 2009.

– "Transport simulations with spectral element discontinuous Galerkin methods," Minisymposium of SIAM Annual Meeting, San Diego, Jul. 7–11, 2008.

– "Fourier spectral simulations for beam dynamics in accelerating structures," Minisymposium for The International Conference On Spectral and High Order Methods (ICOSAHOM), Beijing, China, Jun. 18–22, 2007.

– "Spectral methods for electromagnetic waves in discontinuous media," The 6th International Conference on Spectral and High-Order Methods (ICOSAHOM), Recent Advances in Spectral Methods and High Order Finite Difference Schemes, Brown University, Providence, Jun. 21–25, 2004.

– "Spectral methods for 2D photonic band structures," Photonic Band Gap Materials and Devices II (OE12) as a part of SPIE's International Symposium on Integrated Optoelectronic Devices, San Jose, Jan. 26–29, 2004.

(7) Invited Seminars and Colloquia

– "High-order methods for multiphysics applications," Clements Scientific Computing Seminar, Southern Methodist University (SMU), Department of Mathematics, Dallas, Sept. 6, 2018.

– "Jacobian-free Newton Krylov method for solving nonlinear PDEs", Ocean University of China, Qingdao, China, Mar. 27–28, 2018.

– "Spectral element simulations for ion channel modeling with protein structure data", Ajou University, Seoul, Korea, March 22, 2018.

– "Efficient high-order algorithms for drift-diffusion and electromagnetic systems", University of Illinois at Chicago, Nov. 19, 2017.

– "Scalable high-order methods for PDEs and applications," NCTS Interdisciplinary Research Seminar, National Taiwan University, Taipei, Taiwan, Feb. 23, 2017.

– "Scalable high-order simulations for PDEs and applications," UB Applied Mathematics Seminar, University of Buffalo, Nov. 15, 2016.

– "Scaling limits for transport simulations based on high-order spectral element discretizations," The 2nd International Conference in Applied Mathematics and Scientific Computing, Ocean University of China, Qingdao, China, Aug. 16–18, 2015.

– "Scalable high-order algorithms and simulations for electromagnetics and fluids," Colloquium at Department of Mathematics, Iowa State University, Ames, Nov. 19, 2013.

– "High-order algorithms and performance for PDEs in electromagnetics and fluids," Scientific Computing Group Seminar, Brown University, Providence, Oct. 25, 2013.

– "Scalable algorithms toward exascale computing for energy applications," Seminar at the Center for Computational & Applied Mathematics, Purdue University, West Lafayette, Feb. 22, 2013.

– "High-performance high-order algorithms for scientific applications in electromagnetics and fluids," Seminar at the Department of Mechanical Engineering, The City University of New York, New York, Mar. 31, 2011.

– "High-performance high-order algorithms for electromagnetics and fluids," Meeting with UIC SIAM students, MCS/ANL, Mar. 14, 2011.

– "Scalable high-order algorithms for applications in plasmonics, particle accelerator physics, and fluids," Computational and Applied Mathematics Seminar, Department of Mathematics, Purdue University, West Lafayette, Apr. 23, 2010.

– "NekCEM: High-performance electromagnetic simulations," Mathematics and Its Applications Seminar at University of Illinois at Chicago, Feb. 25, 2009.

– "High-performance electromagnetic modeling," Applied and Computational Math Seminar at University North Carolina at Charlotte, Charlotte, Jan. 28, 2009.

– "High-order simulations for wakefield calculations," Advanced Photon Source Division, Argonne National Laboratory, Jan. 22, 2007.

– "Spectral methods for discontinuous problems," Computer Science and Mathematics Division, Argonne National Laboratory, Oct. 2003.

– "Spectral methods for discontinuous problems," Computer Science and Mathematics Division, Oak Ridge National Laboratory, Oct. 2003.

– "Spectral methods for discontinuous problems," Colloquium, Department of Mathematics, University of Central Florida, Mar. 2003.

(8) Contributed Talks

– "Electromagnetics: Algorithms and software development", Rapid-fire Presentation, MCS, ANL, Jul. 31, 2017.

– "High-order methods for computational electromagnetics," Rapid-fire Presentation, MCS, ANL, Jun. 23, 2014.

– "High-performance algorithms for wakefield calculations," Particle Accelerator Conference (PAC), New York, Mar. 28–Apr. 1, 2011.

– "Programming software for electromagnetics", Particle Accelerator Conference (PAC), New York, Mar. 28–Apr. 1, 2011.

– "Accelerator modeling," LANS Informal Seminar, Argonne, Aug. 29, 2007.

– "Spectral element discontinuous Galerkin simulations for waveguiding structures," PIERS 2006 in Tokyo Progress in Electromagnetics Research Symposium, Tokyo, Japan, Aug. 2–5, 2006.

– "Exponential Integrator based on a Krylov projection method," LANS Seminar, Mathematics and Computer Science Division, Argonne National Laboratory, Jun. 13, 2006.

– "Spectral element discontinuous Galerkin simulations for metallic nanoparticles," PIERS 2006 in Cambridge - Progress in Electromagnetics Research Symposium, Boston, Mar. 26–29, 2006.

– "Spectral element discontinuous Galerkin simulations for photonic crystals," Photonic Band Gap Material and Devices II (OE12) as a part of SPIE's International Symposium on Integrated Optoelectronic Devices at San Jose, Jan. 22–26, 2006.

– "High-order methods for nanophotonics and photonic crystals," Mathematics and Computer Science Division, Argonne National Laboratory, Oct. 14, 2005.

– "Discontinuous Galerkin method based on quadrilateral mesh for Maxwell's equations," ACES/IEEE International Conference on Wireless Communications and Applied Computational Electromagnetics, Honolulu, Apr. 4–7, 2005.

– "A fast version of the Gegenbauer method and its application to medical image reconstruction," Applied Math Days in Rensselaer Polytechnic Institute, Troy, Oct. 2000.

– "Spectral element discontinuous Galerkin lattice Boltzmann simulation flow past two cylinders in tandum with exponential time integrator," The 7th International Conference for Mesoscopic Method in Engineering and Science (ICMMES), Jul. 12–16, 2010.

– "Spectral element discontinuous Galerkin lattice Boltzmann method," The 5th MIT Conference on Computational Fluid & Solid Mechanics, Boston, Jun. 18, 2009.

– "Exponential time integrator for solving lattice Boltzmann equation based on a spectral-element discontinuous Galerkin approach,", The 62nd Annual Meeting of the American Physical Society (APS), Minneapolis, Minnesota, Nov. 22, 2009.

(9) Posters

– (invited), "Center for Efficient Exascale Discretizations," 2020 Exascale Computing Project Annual Meeting, Houston, Feb. 3–7, 2020.

– (invited), "High-Order Methods for High-Performance Multiphysics Simulations," DOE ASCR Applied Math PI meeting, Rockville, Jan 28–30, 2019.

– (invited), "Center for Efficient Exascale Discretizations," 2019 Exascale Computing Project Annual Meeting, Houston, Jan. 14–18, 2019.

– (invited), "Center for Efficient Exascale Discretizations," 2018 Exascale Computing Project Annual Meeting, Knoxville, Feb. 5–9, 2018.

– (invited), "Spectral element simulation for nanowire solar wells on HPC platforms," DOE ASCR PI Meeting, Rockville, Sept. 11–12, 2017.

– (invited), "Center for Efficient Exascale Discretizations," 2017 Exascale Computing Project Annual Meeting, Knoxville, Jan. 31–Feb. 2, 2017.

– (invited), "Center for Efficient Exascale Discretizations," Argonne Exascale Computing Project Town Hall Meeting, ANL, Jan. 24, 2017.

– (invited), "Extreme-scale modeling for transport simulations," University of Chicago CELS Review: Extreme-scale modeling for transport simulations, ANL, Sept. 19, 2012.

– (invited), "Efficient high-order algorithms for nanoscience simulations," DOE Applied Mathematics Research Program PI Meeting, Berkeley, May 3–5, 2010.

– "Scalable high-order algorithms for Wakefield simulations," The 1st International Particle Accelerator Conference (IPAC), Kyoto, Japan, May 23–28, 2010.

– (invited), "Large-scale electromagnetic modeling based on high-order methods: Nanoscience applications," SciDAC Conference 2009, San Diego, Jun. 15–18, 2009.

– (invited), "Computational Nanophotonics: NEKCEM, Office of Advanced Scientific Computing Research," Applied Math Research Program Annual PI Meeting, May 22–24, 2007.

– "Spectral element discontinuous Galerkin simulations with moving window," The 23rd Particle Accelerator Conference (PAC), Vancouver, Canada, May 4–8, 2009.

– "Wake fields for TESLA cavity structures: Spectral element discontinuous Galerkin simulations," RF Superconductivity (SRF07), Beijing, China, Oct. 14–19, 2007.

– "Spectral-element discontinuous Galerkin simulations for bunched beam in accelerating structures," The 22nd Particle Accelerator Conference (PAC), Albuquerque, Jun. 25–29, 2007.

– "Fourier spectral simulations for wake field in conducting cavities," The 22nd Particle Accelerator Conference (PAC), Albuquerque, Jun. 25–29, 2007.

– (invited), "Computational nanophotonics," Science Careers in Search of Women Conference, ANL, Mar. 8, 2007.

(10) Open-Source Software

– NekCEM (lead author): https://github.com/NekCEM/NekCEM electromagnetic solver
– NekLBM (lead author): https://neklbm.mcs.anl.gov high-order lattice Boltzmann solver
– NekRS (management): https://github.com/Nek5000/nekRS C++ version of Nek5000
– Nek5000 (contributor): https://github.com/Nek5000/Nek5000 [openacc branch] CFD solver
– Nekbone (contributor): https://github.com/Nek5000/Nekbone [cuda-openacc branch] miniapp
– gslib (contributor): https://github.com/Nek5000/gslib [openacc branch] communication library

I am the lead developer of NekCEM, which is an open-source high-order multiphysics code that supports computational electromagnetics (Maxwell's equations), drift-diffusion (Poisson-Nernst-Planck equations), Schrödinger, Helmholtz, and quantum density matrix equation solvers. I have also developed NekLBM, which is a lattice Boltzmann solver for the Navier-Stokes equations. In contrast to standard LBM codes, NekLBM uses a novel spectral-element discontinous-Galerkin (SEDG) formulation for the streaming step, which allows for efficient and variable mesh resolution. I developed the first GPU-enabled variant of the Nek code suite using OpenACC + NekCEM on OLCF Titan. This work laid the foundation for subsequent OpenACC variants of Nek5000 and for the current developments in NekRS, which is the OCCA-based version of Nek5000 that is targeted for DOE's forthcoming exascale platforms.

- Supervision

Since arriving at Argonne, I have consistently worked with summer and co-op students. I do not necessarily work with many different students, but rather have been successful in directing top students and retaining them for the duration of their graduate studies. Several have become ANL staff or post-docs.

– Yu-Hsiang Lan (ANL)

  ◦ Projects: Ion channel, Navier-Stokes, RANS, HPC/Exascale (NekCEM, Nek5000, NekRS)
  ◦ Co-authored 5 journal papers, 8 technical papers
  ◦ Aug. 2018–present, Predoc, ANL/MCS
  ◦ 2017–2018, ANL/MCS Summer Intern and Co-Op (Math, National Taiwan University)

- Ali Karakus (Assistant Professor, Middle East Technical University)
  - Projects: OCCA/libParanumal integration into NekRS
  - Co-authored 3 journal papers
  - Nov. 2018–Mar. 2020, ANL/MCS Postdoc
- Matt Otten (Argonne Maria Goeppert Mayer Fellow)
  - Projects: Maxwell solver OpenACC-based GPU porting, quantum solver (NekCEM, gslib)
  - Co-authored 6 journal papers
  - Co-Sponsor, Nov. 2018–present, Argonne Named Fellow (MGM Fellow)
  - 2014–2017, ANL/MCS Summer Intern and Co-Op (Physics, Cornell University)
- Saumil Patel (Assistant Computational Scientist, ANL/CPS)
  - Projects: Spectral element discontinuous Galerkin lattice Boltzmann flow solver with heat (NekLBM)
  - Co-authored 3 journal papers, 2 technical papers, 1 ALCC proposal
  - Co-Superviser, Apr. 2016–2018, ANL/ALCF Postdoc
  - 2013, ANL/MCS Summer Intern (Mech. Eng., CUNY)
- Ying He
  - Projects: NekCEM development with acousticc solver (NekCEM)
  - Co-authored 1 journal paper
  - 2014–2015, contractor, Ying He (Postdoc, UC Davis)
  - 2012–2013, ANL/MCS Summer Intern (Math, Purdue University)
- Thilina Rathanayake (Ph.D. Student, UIUC)
  - Co-authored 4 journal papers, 9 technical reports
  - Projects: HPC and Performance Analysis (Nek5000)
  - 2018–2019, ANL/MCS Summer Intern (Compter Science, UIUC)
- Josh Wilson
  - Projects: Graphen-based 2D material modeling (NekCEM)
  - Co-authored 1 journal paper
  - Jan. 2017–Aug. 2017, DOE Office of Science Graduate Student Research (SCGSR) Fellow
  - Oct. 2017–May. 2018, ANL/MCS Co-Op (Math, University of Minnesota)
- Jing Fu
  - Projects: Parallel I/O (MPIIO collective/reduced blocking/threads into NekCEM)
  - Co-authored 2 journal papers
  - 2010–2012, ANL/MCS Summer Intern and Co-Op (Computer Science, RPI)
- Pablo Brubeck (Ph.D. Student, Math, Oxford University)
  - Projects: Fast diagonalizagtion for nonsymmetric operator in steady thermal fluid solver (Nek5000)
  - Ongoing paper
  - Feb. 2019–Aug. 2019, ANL/MCS Predoc
  - 2018, ANL/MCS Summer Intern
- Kalu Uga
  - Projects: Spectral element discontinuous Galerkin lattice Boltzmann solver (NekLBM)
  - Co-authored 2 journal papers
  - 2010, ANL/MCS Summer Intern (Mech. Eng., CUNY)
- Kento Kaneko (Ph.D. Student, UIUC)
  - Projects: Direct Newton method for Steady fluid sovler (Nek5000)
  - Ongoing paper
  - 2018, ANL/MCS Summer Intern (Mech. Eng., UIUC)
  - Aug. 2017, ANL/MCS Graduate Student Visitor Mech. Eng., UIUC)

- PingHsuan Tsai (Ph.D. Student, UIUC)
  - Projects: Steady solver for ion transport (NekCEM)
  - Ongoing papers
  - 2019, ANL/MCS Summer Intern (Computer Science, UIUC)
  - 2017, ANL/MCS Summer Intern (Math, National Taiwan University)
- Lukas Spies (Ph.D. Student, UIUC)
  - Projects: Performance Analysis (NekBench)
  - Ongoing paper
  - 2020, ANL/MCS Summer Intern (Computer Science, UIUC)
- Li Lu
  - Projects: Schwarz smoothing with multigrid preconditioning (Nek5000)
  - Contribution to the development of steady solver into Nek5000
  - 2018, ANL/MCS Summer Intern (Mech. Eng., UIUC)
- Mike Fairchild
  - Projects: Maxwell solver (NekCEM)
  - Contribution to the development of NekCEM electromagnetic solver
  - 2009, ANL/MCS Summer Intern (Math, University of North Carolina, Charlotte)
- Guy Cobb
  - Projects: Maxwell solver (NekCEM)
  - Contribution to the development of NekCEM electromagnetic solver
  - 2008, ANL/MCS Summer Intern (Computer Science, University of Colorado, Boulder)
- Andreas Kloeckner (UIUC)
  - Projects: Spectral element discontinuous Galerkin Maxwell solver (NekCEM)
  - Contribution to the development of NekCEM electromagnetic solver
  - 2006, ANL/MCS Summer Intern (Applied Math, Brown University)

- Management
  - Contractor: Ananias Tomboulides, Aug. 1, 2018–present.
  - Contractor: Stefan Kerkemeier, Jul. 1, 2017–present.
- Computing Awards
  - (PI) ALCF Theta-GPU, Director's Discretionary Allocation on Aerosoal Transport Modeling Towards Exascale, (5000 nodes hours awarded), 2020.
  - (Co-PI) DOE 2021 INCITE proposal: Philippe Spalart, Ramesh Balakrishnan, Aleks Obabko, Misun Min, and Paul Fischer, "Direct Numerical Simulation of Separated Flow over a Speed Bump at Higher Reynolds Numbers," (585,000 node hours awarded), Jun. 2020.
  - (Co-PI) DOE ASCR Leadership Computing Challenge: Elia Merzari, Paul Fischer, Misun Min, Derek Gaston, and Paul Romano, "High-Fidelity Multi-Physics Simulation of Pebble Bed Cores," (300,000 node hours awarded), OLCF Summit, 2019.
  - (Co-PI), DOE ASCR Leadership Computing Challenge: Paul Fischer, Ananias Tomboulides, George Giannakopoulos, Christos Frouzakis, Misun Min, Saumil Patel, "High-Fidelity Simulations of Flow and Heat Transfer of an Internal Combustion Engine," (30M node hours awarded), ALCF Theta, 2018.
  - (ANL Lead), ALCF Theta Early Science Program (ESP), Christos Frouzakis, Ananias Tomboulides, Paul Fischer, and Misun Min, "Flow, Mixing and Combustion of Transient Turbulent Gaseous Jets in Confined Cylindrical Geometries," awarded, FY2016.

Updated on November 16, 2020