Curriculum Vitae

Andreas Kloeckner
Department of Computer Science
University of Illinois at Urbana-Champaign
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Education

2010	Ph.D. in Applied Mathematics Division of Applied Mathematics, Brown University, Providence, RI *High-Performance High-Order Simulation of Wave and Plasma Phenomena*
2006	M.Sc. in Applied Mathematics Division of Applied Mathematics, Brown University, Providence, RI
2005	Diplom degree in Applied Mathematics (Technomathematik) Institut für Angewandte Mathematik, Universität Karlsruhe, Germany *On the Computation of Maximally Localized Wannier Functions*

Experience

8/2019 –	Associate Professor *Computer Science, University of Illinois at Urbana-Champaign*
8/2013 – 8/2019	Assistant Professor *Computer Science, University of Illinois at Urbana-Champaign*
1/2016 –	Affiliate Faculty Member *Electrical and Computer Engineering, University of Illinois at Urbana-Champaign*
9/2010 –7/2013	Courant Instructor *Courant Institute of Mathematical Sciences, New York University, New York City* (with Leslie Greengard)
2007 – 2010	Graduate Research Assistant *Division of Applied Mathematics, Brown University, Providence, RI* (with Jan Hesthaven and Tim Warburton)
6/2006 – 9/2006	J. Wallace Givens Research Associate *Mathematics and Computer Science Div., Argonne Nat'l Laboratory, Illinois* Designed high-order unstructured electromagnetic simulation methods for particle accelerators. (with Paul Fischer, Misun Min, and colleagues at ANL's Advanced Photon Source)

Awards and Achievements

2019	'List of teachers ranked as excellent by their students', University of Illinois at Urbana-Champaign, Fall 2019.
2018	University of Illinois Engineering Council Outstanding Advising Award
2017	National Science Foundation CAREER Award (Computational Mathematics Program, grant number DMS-1654756)
2016	C.W. Gear Outstanding Junior Faculty Award (Dept. of Computer Science, University of Illinois at Urbana-Champaign)
2015	Recipient of Google 'Gift for Open Source Friends' for work on `pudb`
2015	'List of teachers ranked as excellent by their students', University of Illinois at Urbana-Champaign, Spring 2015.
2015	'Best minisymposterium' on 'Scalable Finite Element Assembly' at SIAM Computational Science and Engineering (Salt Lake City, UT) (presented one of the constituent posters)
2013	Travel Award for SIAM Conference on Computational Science and Engineering (Boston, MA)
2012	NSF US Junior Oberwolfach Fellowship Travel grant to attend the Oberwolfach workshop "Theory and Applications of Discontinuous Galerkin Methods"
2012	Travel Award for SIAM Conference on Parallel Processing for Scientific Computing (Savannah, GA)
2010	David Gottlieb Memorial Award of the Division of Applied Mathematics at Brown University
2010	NSF US Junior Oberwolfach Fellowship Travel grant to attend the Oberwolfach workshop "Computational Electromagnetism and Acoustics"
2009	Brown University Dissertation Fellowship
2001	DaimlerChrysler Scholarship Program

Research

The unifying theme of my research interest is the efficient numerical simulation of wave phenomena. I have worked towards this goal by pursuing a broad range of topics:

Efficient Building Blocks for Integral Equation Methods. Integral equation methods are a promising approach for the numerical solution of elliptic boundary value problems, because of their low cost, easy treatment of exterior problems, and benign conditioning. Their broad adoption is hindered by lack of general-purpose tools. Quadrature by Expansion (QBX) is a method for the high-order accurate evaluation of layer potentials which I have co-developed. With an ecosystem of theoretical results, asymptotically fast algorithms, and large scale software that I am developing, it holds the promise to become the general-purpose, fast, and scalable tool for integral equations currently missing from the scientific computing landscape.

Tools for Scientific Programming. The advent of massive on-chip parallelism is in the process of turning commonly accepted cost metrics in numerical analysis on their heads. This phenomenon includes, but is not limited to, GPU hardware. Increasingly, proof-of-concept implementations (e.g. in MATLAB) risk being unaware of the drivers of computational cost, and, consequently, are prone to producing methods that are not scalable on actual hardware. Making current computer architectures accessible to numerical analysts is a question of tools and abstractions. I am pursuing a long-term program to develop such a set of languages and tools fundamentally based on the notion of run-time code generation, presenting an alternative point of view to commonly accepted software construction practice.

Numerical Methods for Hyperbolic PDEs. Using time-explicit discontinuous Galerkin ("DG") methods as a starting point, I am investigating problems arising in applications, such as those arising in computational electromagnetics, as well numerical subjects, such as detection and mitigation methods for Gibbs phenomena encountered in shock-laden flows. I have further developed a number of multi-rate time integration methods to be used in conjunction with DG.

Publications

See `http://goo.gl/sjZ2E` for a research impact summary compiled by Google Scholar.

Journal Articles

2023	Automatic Synthesis of Low-Complexity Translation Operators for the Fast Multipole Method. *I. Fernando,* ***A. Klöckner*** Submitted to Journal of Computational Physics. (May 2023) See `https://arxiv.org/abs/2305.17867`.
2023	Integral Equation Methods for the Morse-Ingard Equations. *X. Wei,* ***A. Klöckner****, R. C. Kirby* Accepted in Journal of Computational Physics. (August 2023) See `https://arxiv.org/abs/2210.12542`.
2022	Exact domain truncation for the Morse-Ingard equations. *R. C. Kirby, X. Wei,* ***A. Klöckner*** Submitted to Computers and Mathematics with Applications. (October 2022) See `https://arxiv.org/abs/2210.13765`.

2021 Finite elements for Helmholtz equations with a nonlocal boundary condition.
R. C. Kirby, ***A. Klöckner****, B. Sepanski*

SIAM Journal on Scientific Computing, Volume 43, Issue 3, pp. A1671–A1691. (May 2021) Available at doi:10.1137/20M1368100. Also at arXiv:2009.08493.

2020 On the Approximation of Local Expansions of Laplace Potentials by the Fast Multipole Method.
M. Wala, ***A. Klöckner***

Submitted to SIAM Journal on Numerical Analysis. (August 2020) See `https://arxiv.org/abs/2008.00653`.

2020 A mechanism for balancing accuracy and scope in cross-machine black-box GPU performance modeling.
J. D. Stevens, ***A. Klöckner***

International Journal of High Performance Computing Applications. (June 2020) Available at doi:10.1177/1094342020921340. Also at arXiv:1904.09538.

2020 SciPy 1.0—Fundamental Algorithms for Scientific Computing in Python.
P. Virtanen, R. Gommers, T. E. Oliphant, M. Haberland, T. Reddy, D. Cournapeau, E. Burovski, P. Peterson, W. Weckesser, J. Bright, S. J. v. d. Walt, M. Brett, J. Wilson, K. J. Millman, N. Mayorov, A. R. J. Nelson, E. Jones, R. Kern, E. Larson, C. Carey, İ. Polat, Y. Feng, E. W. Moore, J. VanderPlas, D. Laxalde, J. Perktold, R. Cimrman, I. Henriksen, E. Quintero, C. R. Harris, A. M. Archibald, A. H. Ribeiro, F. Pedregosa, P. v. Mulbregt, ***SciPy 1.0 Contributors (includes AK)***

Nature Methods. (January 2020) Available at doi:10.1038/s41592-019-0686-2. Also at arXiv:1907.10121.

2020 An Integral Equation Method for the Cahn-Hilliard Equation in the Wetting Problem.
X. Wei, S. Jiang, ***A. Klöckner****, X. Wang*

Journal of Computational Physics, Volume 419, pp. 109521. (October 2020) Available at doi:10.1016/j.jcp.2020.109521. Also at arXiv:1904.07357.

2020 A study of vectorization for matrix-free finite element methods.
T. Sun, L. Mitchell, K. Kulkarni, ***A. Klöckner****, D. A. Ham, P. H. J. Kelly*

International Journal of High Performance Computing Applications, Volume 34, Issue 6, pp. 629–644. (November 2020) Available at doi:10.1177/1094342020945005. Also at arXiv:1903.08243.

2020 Multiscale Hydrophobic Lipid Dynamics Simulated by Efficient Integral Equation Methods.
S. P. Fu, R. J. Ryham, ***A. Klöckner****, M. Wala, S. Jiang, Y. Young*

SIAM Multiscale Modeling and Simulation, Volume 18, Issue 1, pp. 79–103. (February 2020) Available at doi:10.1137/18M1219503. Also at arXiv:1810.04131.

2019 Optimization of Fast Algorithms for Global Quadrature by Expansion Using Target-Specific Expansions.
M. Wala, ***A. Klöckner***

Journal of Computational Physics, Volume 403. (October 2019) Available at doi:10.1016/j.jcp.2019.108976. Also at arXiv:1811.01110.

2019 Multi-Rate Time Integration on Overset Meshes.
C. Mikida, ***A. Klöckner****, D. Bodony*

Journal of Computational Physics, Volume 396, pp. 325–346. (November 2019) Available at doi:10.1016/j.jcp.2019.06.021. Also at arXiv:1805.06607.

2019 A Fast Algorithm for Quadrature by Expansion in Three Dimensions.
M. Wala, ***A. Klöckner***

Journal of Computational Physics, Volume 388, pp. 655–689. (July 2019) Available at doi:10.1016/j.jcp.2019.03.024. Also at arXiv:1805.06106.

2018 High-order Finite Element–Integral Equation Coupling for Elliptic Problems on Embedded Meshes.
N. N. Beams, ***A. Klöckner****, L. N. Olson*

Journal of Computational Physics, Volume 375, pp. 1295–1313. (December 2018) Available at doi:10.1016/j.jcp.2018.08.032. Also at arXiv:1804.02736.

2018 Conformal Mapping via a Density Correspondence for the Double-Layer Potential.
M. Wala, ***A. Klöckner***

SIAM Journal on Scientific Computing, Volume 40, Issue 6, pp. A3715-–A3732, SIAM, Philadelphia, PA. (November 2018) Available at doi:10.1137/18M1174982. Also at arXiv:1602.04855.

2018 A Fast Algorithm with Error Bounds for Quadrature by Expansion.
M. Wala, ***A. Klöckner***

Journal of Computational Physics, Volume 374, pp. 135–162, Elsevier. (May 2018) Available at doi:10.1016/j.jcp.2018.05.006. Also at arXiv:1801.04070.

2017 Fast algorithms for Quadrature by Expansion I: Globally valid expansions.
M. Rachh, ***A. Klöckner****, M. O'Neil*

Journal of Computational Physics, Volume 345, pp. 706–731, Elsevier. (September 2017) Available at doi:10.1016/j.jcp.2017.04.062. Also at arXiv:1602.05301.

2014 Visualizing Skin Effects in Conductors with MRI: ^{7}Li MRI Experiments and Calculations.
A. Ilott, S. Chandrashekar, ***A. Klöckner****, H. J. Chang, N. Trease, C. Grey, L. Greengard, A. Jerschow*

J. Magn. Res., Volume 2014, pp. 143–149. (July 2014) Available at doi:10.1016/j.jmr.2014.06.013. Also at arXiv:1403.6072.

2013 On the convergence of local expansions of layer potentials.
C. Epstein, L. Greengard, ***A. Klöckner***

SIAM Journal on Numerical Analysis, Volume 51, Issue 5, pp. 2660–2679. (September 2013) Available at doi:10.1137/120902859. Also at arXiv:1212.3868.

2013 Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials.
A. Klöckner*, A. Barnett, L. Greengard, M. O'Neil*

Journal of Computational Physics, Volume 252, pp. 332–349. (November 2013) Available at doi:10.1016/j.jcp.2013.06.027. Also at arXiv:1207.4461.

2012 A consistency condition for the vector potential in multiply-connected domains.
C. Epstein, Z. Gimbutas, L. Greengard, ***A. Klöckner****, M. O'Neil*

IEEE Transactions on Magnetics, Volume 49, Issue 3. (October 2012) Available at doi:10.1109/TMAG.2012.2223480. Also at arXiv:1203.3993.

2011 Viscous Shock Capturing in a Time-Explicit Discontinuous Galerkin Method.
***A. Klöckner**, T. Warburton, J. S. Hesthaven*

Mathematical Modelling of Natural Phenomena, Volume 6, Issue 3. (May 2011) Available at doi:10.1051/mmnp/20116303. Also at arXiv:1102.3190.

2011 PyCUDA and PyOpenCL: A Scripting-Based Approach to GPU Run-Time Code Generation.
***A. Klöckner**, N. Pinto, Y. Lee, B. Catanzaro, P. Ivanov, A. Fasih*

Parallel Computing, Volume 38, Issue 3, pp. 157—174. (September 2011) Available at doi:10.1016/j.parco.2011.09.001. Also at arXiv:0911.3456.

2009 Nodal Discontinuous Galerkin Methods on Graphics Processors.
***A. Klöckner**, T. Warburton, J. Bridge, J. S. Hesthaven*

Journal of Computational Physics, Volume 228, Issue 21. (November 2009) Available at doi:10.1016/j.jcp.2009.06.041. Also at arXiv:0901.1024.

Conference Proceedings (Peer-Reviewed)

2016 Array Program Transformation with Loo.py by Example: High-Order Finite Elements.
***A. Klöckner**, L. C. Wilcox, T. Warburton*

Proceedings of ARRAY 2016: ACM SIGPLAN Workshop on Libraries, Languages, and Compilers for Array Programming, Santa Barbara, CA, Association for Computing Machinery. (June 2016) Available at doi:10.1145/2935323.2935325. Also at arXiv:1604.08501.

2015 Loo.py: From Fortran to performance via transformation and substitution rules.
A. Klöckner

Proceedings of ARRAY 2015: ACM SIGPLAN Workshop on Libraries, Languages, and Compilers for Array Programming, Portland, OR, Association for Computing Machinery. (June 2015) Available at doi:10.1145/2774959.2774969. Also at arXiv:1503.07659.

2014 Loo.py: transformation-based code generation for GPUs and CPUs.
A. Klöckner

Proceedings of ARRAY 2014: ACM SIGPLAN Workshop on Libraries, Languages, and Compilers for Array Programming, Edinburgh, UK, Association for Computing Machinery. (June 2014) Available at doi:10.1145/2627373.2627387. Also at arXiv:1405.7470.

2013 High-Order Discontinuous Galerkin Methods by GPU Metaprogramming.
***A. Klöckner**, T. Warburton, J. S. Hesthaven*

Proceedings of the 2010 Workshop of GPU Solutions to Multiscale Problems in Science and Engineering, Harbin, China, Springer. (January 2013) See `https://arxiv.org/abs/1211.0582` and `http://books.google.com/books?vid=9783642164040`.

2011 A Common GPU n-Dimensional Array for Python and C.
F. Bastien, A. Bergeron, ***A. Klöckner****, P. Vincent, Y. Bengio*

Proceedings of the Workshop "Big Learning: Algorithms, Systems, and Tools for Learning at Scale" at NIPS 2011. (December 2011) See `http://www.iro.umontreal.ca/~lisa/publications2/index.php/publications/show/522`.

Book Chapters (Peer-Reviewed)

2011 Solving Wave Equations on Unstructured Geometries.
A. Klöckner*, T. Warburton, J. S. Hesthaven*

GPU Computing Gems "Jade Edition", Morgan Kaufmann Publishers, Waltham, MA. (November 2011) Available at doi:10.1016/B978-0-12-385963-1.00018-6. Also at arXiv:1304.5546.

2011 GPU Scripting and Code Generation with PyCUDA.
A. Klöckner*, N. Pinto, Y. Lee, B. Catanzaro, P. Ivanov, A. Fasih*

GPU Computing Gems "Jade Edition", Morgan Kaufmann Publishers, Waltham, MA. (November 2011) Available at doi:10.1016/B978-0-12-385963-1.00027-7. Also at arXiv:1304.5553.

Conference Proceedings (Other)

2012 Tools and Methods for Discontinuous Galerkin Solvers on Modern Computer Architectures.
A. Klöckner*, T. Warburton, J. S. Hesthaven*

Proceedings of the 2012 Oberwolfach Workshop "Theory and Applications of Discontinuous Galerkin Methods" (1208a), Oberwolfach, Germany. (February 2012)

2009 Overcoming Performance Bottlenecks in DG-FEM for EM Problems.
S. Chun, H. Haddar, J. S. Hesthaven, ***A. Klöckner****, T. Warburton, L. Wilcox*

Proceedings of 9th International Conference on Mathematical and Numerical Aspects of Wave Propagation, pp. 80–81, Pau, France. (June 2009)

Technical Reports

2016 A Unified, Hardware-Fitted, Cross-GPU Performance Model.
J. Stevens, ***A. Klöckner***

Technical report. (April 2016) See `https://arxiv.org/abs/1604.04997`.

2009 Deterministic Numerical Schemes for the Boltzmann Equation.
A. Narayan, ***A. Klöckner***

Brown University Scientific Computing Technnical Report, Providence, RI 2009-39. (September 2009) See `https://arxiv.org/abs/0911.3589`.

Research Presentations

11/2022 HPC for Idealists with Deadlines: Pragmatic Abstractions for High Performance. Invited Seminar. Groupe Calcul, Centre national de la recherche scientifique (France). (online).

11/2022 HPC for Idealists with Deadlines: Pragmatic Abstractions for High Performance. Scientific Computing Seminar. Simula Research. Oslo, Norway.

5/2022 Moderator of Panel Discussion 'Community Software'. Workshop "Outstanding Challenges in Computational Methods for Integral Equations". Casa Matemática Oaxaca (CMO). Oaxaca, Mexico.

2/2022 UFL to GPU: Generating Near-Roofline Finite Element Action Kernels. Minisymposium 17, organized by Piotr Luszczek. SIAM Conference on Parallel Processing for Scientific Computing. Seattle, WA (online).

10/2021 Fast Algorithms for the Evaluation of Layer Potentials. Center for Computational and Applied Mathematics (CCAM) Seminar. Purdue University. West Lafayette, IN (online).

7/2021 Automatic Synthesis of Low-Complexity Translation Operators for the Fast Multipole Method. International Conference on Spectral and High Order Methods (ICOSAHOM) 2020. Technische Universität Wien. Vienna, Austria (online).

2/2021 High-performance code generation for heterogeneous machines in Python. Python break-out session, 12th JLESC workshop. Joint Laboratory on Extreme-Scale Computing. (online).

10/2020 Fast Algorithms for the Evaluation of Layer and Volume Potentials. Applied Mathematics Seminar. Baylor University. Waco, TX (online).

10/2019 Fast Algorithms for the Evaluation of Layer and Volume Potentials. Applied Mathematics Colloquium. University of Colorado at Boulder. Boulder, CO.

6/2019 Fast Algorithms for the Evaluation of Layer and Volume Potentials. North American High Order Methods Conference (NAHOMCon) 2019. San Diego State University. San Diego, CA.

2/2019 Symbolic Computation for Layer Potential Evaluation with Quadrature by Expansion. Minisymposium 140 Computational Scalability and Complex Geometry in Integral Equation Methods. SIAM Conference on Computational Science and Engineering 2019. Spokane, WA.

9/2018 Guaranteed-Accuracy Fast Algorithms for the Evaluation of Layer Potentials using Quadrature by Expansion. Department of Mathematics Colloquium. Virginia Polytechnic Institute and State University. Blacksburg, VA.

8/2018	Frequency Domain Electromagnetics with Guaranteed-Accuracy Accelerated 'Quadrature by Expansion'. 15th Annual Conference on Frontiers in Applied and Computational Mathematics (FACM '18). New Jersey Institute of Technology. Newark, NJ.
7/2018	Frequency Domain Electromagnetics with Guaranteed-Accuracy Accelerated 'Quadrature by Expansion'. International Conference on Spectral and High Order Methods (ICOSAHOM) 2018. Imperial College. London, UK.
4/2018	Guaranteed-Accuracy Fast Algorithms for the Evaluation of Layer Potentials using 'Quadrature by Expansion'. UIC Analysis and Applied Mathematics Seminar. University of Illinois at Chicago. Chicago, IL.
4/2018	Guaranteed-Accuracy Fast Algorithms for the Evaluation of Layer Potentials using 'Quadrature by Expansion'. CSCAMM (Center for Scientific Computation and Mathematical Modeling) Seminar Series. University of Maryland. College Park, MD.
10/2017	User Interfaces to Performance: Kernel Transformation with Loopy. Dagstuhl Seminar 17431: 'Performance Portability in Extreme Scale Computing: Metrics, Challenges, Solutions'. Schloss Dagstuhl – Leibniz-Zentrum für Informatik. Wadern, Germany.
10/2017	Guaranteed-Accuracy Fast Algorithms for the Evaluation of Layer Potentials using 'Quadrature by Expansion'. ICES Seminar. University of Texas. Austin, TX.
7/2017	Heterogeneous High-Order DG for Hyperbolic PDEs: Methods and Tools. International Workshop 'Fast High-Order Discontinuous Galerkin Methods for Future Architectures' (Sponsored by DFG Priority Programme 1648 SPPEXA). Mathematikon, Universität Heidelberg. Heidelberg, Germany.
3/2017	Expansion Mechanisms in 'Quadrature by Expansion'. Minisymposium 202 - Quadrature Methods for Singular and Nearly Singular Integrals in Integral Equations. SIAM Conference on Computational Science and Engineering 2017. Atlanta, GA.
1/2017	Introduction to Singular Quadrature, Simulation of Photonic Metamaterials, and Software Frameworks for IEs. ICERM-HKUST VI-MSS workshop on Integral Equation Methods, Fast Algorithms and Their Applications to Fluid Dynamics and Materials Science. Institute of Advanced Study, Hong Kong University of Science and Technology. Hong Kong.
12/2016	Fast Evaluation of Layer Potentials using Quadrature by Expansion for Photonics Applications. Workshop "Mathematical and Numerical Modeling in Optics". Institute for Mathematics and its Applications, University of Minnesota. Minneapolis, MN.
7/2016	High Performance with Python: Architectures, Approaches, and Applications (Invited keynote address). 15th Annual Conference on Scientific Computing with Python (SciPy 2016). University of Texas, Austin, TX.
7/2016	Describe, Don't Implement: Declarative Programming for PDE Solvers (Invited keynote address). PDE Software Frameworks (PDESoft) 2016. University of Warwick, UK.
6/2016	Array Program Transformation with Loo.py by Example: High-Order Finite Elements. Third ACM SIGPLAN International Workshop on Libraries, Languages, and Compilers for Array Programming (co-located with ACM PLDI). Santa Barbara, CA.

2/2016	Loopy: Heterogeneous Code Generation for Array Computations. Tu@XPACC Weekly Seminar of the Center for the Exascale Simulation of Plasma-Coupled Combustion. University of Illinois At Urbana-Champaign. Urbana, IL.
1/2016	Loopy: Heterogeneous Code Generation for Array Computations. Workshop on Exascale Software Technologies (WEST) 2016. Albuquerque, NM.
12/2015	Quadrature By Expansion (Departmental Seminar). Department of Aerospace Engineering, IIT Bombay. Mumbai, India.
12/2015	Domain-specific languages to Manycore and GPU: Building High-Performance Tools with Python (Invited keynote address). International Conference on Python for Education and Scientific Computing (SciPy India) '15. IIT Bombay. Mumbai, India.
12/2015	Loo.py: Status and Progress. Earth System Prediction Capability: Advancing Air-Ocean-Land-Ice Global Coupled Prediction on Emerging Computational Architectures Annual Review Meeting. Arlington, VA.
6/2015	Loo.py: From Fortran to Performance via Transformation and Substitution Rules. Second ACM SIGPLAN International Workshop on Libraries, Languages, and Compilers for Array Programming (co-located with ACM PLDI). Portland, OR.
4/2015	Quadrature by Expansion. Mathematics Department Colloquium. Baylor University. Waco, TX.
3/2015	Fast Algorithms for the Evaluation of Layer Potentials using 'Quadrature by Expansion'. Minisymposium 151 - Software Components for Integral Equation Methods. SIAM Conference on Computational Science and Engineering 2015. Salt Lake City, UT.
11/2014	Loo.py: transformation-based code generation for GPUs and CPUs. Earth System Prediction Capability: Advancing Air-Ocean-Land-Ice Global Coupled Prediction on Emerging Computational Architectures Annual Review Meeting. Boulder, CO.
7/2014	Fast algorithms for 'Quadrature by Expansion'. Minisymposium 142 - Boundary Integral Equations and Their Applications. SIAM Annual Meeting 2014. Chicago, IL.
6/2014	High-order coupling of QBX with discontinuous volume discretizations. Minisymposium 6 - High-Performance High-Order Simulation Tools and Techniques. International Conference on Spectral and High Order Methods (ICOSAHOM) 2014. Salt Lake City, UT.
6/2014	Quadrature by Expansion, plus Python Tools and Techniques for Scientific Computing. Numerical Analysis Seminar. University College. London, UK.
6/2014	Loo.py: transformation-based code generation for GPUs and CPUs. ACM SIGPLAN International Workshop on Libraries, Languages, and Compilers for Array Programming (co-located with ACM PLDI). Edinburgh, Scotland.
5/2014	Quadrature by Expansion, plus Python Tools and Techniques for Scientific Computing. Department of Applied Mathematics, National Dong Hwa University. Hualien City, Taiwan.
5/2014	Bicycles for the Mind: Building High-Performance Tools with Python (Nonplenary keynote address). PyCon APAC 2014. Academia Sinica. Taipei, Taiwan.

5/2014	Bicycles for the Mind: Building High-Performance Tools with Python. Tercer Escuela Argentina de GPGPU para Aplicaciones Científicas. Centro Atómico Bariloche, Instituto Balseiro, Universidad Nacional de Cuyo. Bariloche, Argentina.
3/2014	Quadrature by Expansion, plus Python Tools and Techniques for Scientific Computing. University of Illinois Computational Science & Engineering Seminar. CSE Program. Urbana, IL.
12/2013	Fast Algorithms for Quadrature by Expansion. Integral Equations Methods: Fast Algorithms and Applications. Banff International Research Station for Mathematical Innovation and Discovery. Banff, AB, Canada.
11/2013	Quadrature by Expansion. Graduate Seminar on Antennas, Electromagnetics, Optics and Remote Sensing. University of Illinois at Urbana-Champaign. Urbana, IL.
4/2013	Computational methods in the age of the Free Flop. Graduate Student and Postdoc Seminar. Courant Institute of Mathematical Sciences. New York, NY.
4/2013	Quadrature by Expansion. Waves Seminar. Mathematics Department, New Jersey Institute of Technology. Newark, NJ.
4/2013	Python and GPUs. Seminar "Python in Finance". Bank of America Conference Center/Fountainhead Labs. New York, NY.
3/2013	Quadrature by Expansion. Numerical Analysis and Scientific Computing Seminar. Courant Institute of Mathematical Sciences. New York, NY.
2/2013	Quadrature by Expansion. Minisymposium 72. SIAM Conference on Computational Science and Engineering 2013. Boston, MA.
2/2013	Computational Tools for DG on modern computer architectures. Minisymposium 150. SIAM Conference on Computational Science and Engineering 2013. Boston, MA.
2/2013	Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials. Applied Physics and Applied Mathematics Department, Columbia University. New York, NY.
2/2013	Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials. CS Special Seminar. Computer Science Department, University of Illinois at Urbana-Champaign. Urbana, IL.
2/2013	Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials. Mathematical Modeling and Scientific Computing Seminar. Mathematics Department, Southern Methodist University. Dallas, TX.
2/2013	Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials. Special Lecture. Computational and Applied Mathematics Department, Rice University. Houston, TX.
1/2013	Robust, Efficient, Accurate: High Order Methods in the Age of the Free Flop. Math Colloquium. Mathematics Department, University of North Carolina at Chapel Hill. Chapel Hill, NC.
1/2013	Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials. Numerical Analysis Seminar. Mathematics Department, University of Maryland at College Park. College Park, MD.

1/2013	Quadrature by Expansion: A New Method for the Evaluation of Layer Potentials. Analysis, Dynamics, and Applications Seminar. Mathematics Department, University of Arizona. Tucson, AZ.
10/2012	GPUs and Python (Invited speaker and panelist). PyData NYC—Conference on big data with Python. New York, NY.
10/2012	Quadrature by expansion. Applied Mathematics Seminar. Carolina Center for Interdisciplinary Applied Mathematics, University of North Carolina. Chapel Hill, NC.
9/2012	Transformational Programming for time- and frequency-domain EM simulation (Invited plenary talk). SCEE2012–Scientific Computing in Electrical Engineering. ETH Zurich. Zurich, Switzerland.
5/2012	Easy, Effective, Efficient: GPU Programming in Python with PyOpenCL and PyCUDA. HPC & GPU Supercomputing Group of New York City. New York, NY.
4/2012	POP Quadrature: Painless high-order-accurate layer potentials. Applied & Computational Mathematics Seminar. Dartmouth Co. Hanover, NH.
3/2012	Loo.py: A Loop Generation Tool for CPUs and GPUs. Oil and Gas High Performance Computing Workshop. Rice University. Houston, TX.
2/2012	Tools and Methods for DG on Modern Computer Architectures. Oberwolfach workshop "Theory and Applications of Discontinuous Galerkin Methods". Mathematisches Forschungsinstitut Oberwolfach. Oberwolfach, Germany.
2/2012	High-order DG Wave Propagation on GPUs: Infrastructure and Implementation. Minisymposium 13, organized by Takahiro Katagiri, Toshiyuki Imamura, and Keita Teranishi. SIAM Conference on Parallel Processing for Scientific Computing. Savannah, GA.
1/2012	Loo.py–a polyhedral code generator for CPUs and GPUs (lightning talk, invited attendee). Synchronization-reducing and Communication-reducing Algorithms and Programming Models for Large-scale Simulations. Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University. Providence, RI.
11/2011	Run-time Code Generation for Heterogeneous Computing: Methods and Applications in High-Order PDE Solvers. Red Raider Minisymposium. Texas Tech University. Lubbock, TX.
10/2011	Discontinuous Galerkin, Python, and GPUs: a case study. Workshop 'Programming of Heterogeneous Systems in Physics'. Universität Jena. Jena, Germany.
9/2011	Easy, Effective, Efficient: GPU Programming in Python with PyOpenCL and PyCUDA. HPC & GPU Supercomputing Group of New York City. New York, NY.
8/2011	Run Time Code Generation for Heterogeneous Computing: Methods and Applications in High-Order PDE solvers. Workshop on CBC Key Topics. Center for for Biomedical Computing, Simula Research Laboratory. Lysaker, Norway.
8/2011	Run-time Code Generation for Heterogeneous Computing: Methods and Applications in High-Order PDE Solvers. Workshop 'GPU Computing Today and Tomorrow'. GPULab, Department for Informatics and Mathematical Modelling, Technical University of Denmark. Lyngby, Denmark.

6/2011	Generalized Debye Sources: Computational Aspects on Arbitrary Surfaces. Frontiers in Applied and Computational Mathematics. New Jersey Institute of Technology. Newark, NJ.
5/2011	Discontinuous Galerkin, Python, and GPUs: the 'hedge' solver package. Advances and Challenges in Computational General Relativity. Brown University. Providence, RI.
3/2011	High-order DG Wave Propagation on GPUs: Infrastructure, Implementation, Method Improvements. Scientific Computing and Numerics (SCAN) Seminar. Cornell University. Ithaca, NY.
3/2011	Easy, Effective, Efficient: GPU Programming in Python with PyOpenCL and PyCUDA. Research Seminar. D.E. Shaw Research. New York, NY.
3/2011	High-order DG Wave Propagation on GPUs: Infrastructure, Implementation, Method Improvements. Mechanical Engineering Department, City College of New Yew York. New York, NY.
3/2011	Shock Capturing in a Time-Explicit Discontinuous Galerkin Method on the GPU. Minisymposium 116. SIAM Conference on Computational Science and Engineering 2011. Reno, NV.
3/2011	Paper to GPU: Optimizing and Executing Discontinuous Galerkin Operators in Python. Minisymposium 62. SIAM Conference on Computational Science and Engineering 2011. Reno, NV.
3/2011	High-Order Discontinuous Galerkin Methods by GPU Metaprogramming. Minisymposium 1. SIAM Conference on Computational Science and Engineering 2011. Reno, NV.
2/2011	High-order DG Wave Propagation on GPUs: Infrastructure, Implementation, Method Improvements. Math Department Seminar. UMass Dartmouth. Dartmouth, MA.
1/2011	High-order DG Wave Propagation on GPUs: Infrastructure, Implementation, Method Improvements. Workshop "High Performance Computing and Emerging Architectures". Institute for Mathematics and Its Applications, University of Minnesota. Minneapolis, MN.
12/2010	Machine-adapted Methods: High-order DG Wave Propagation on GPUs. Imaging and Computing Seminar. Mathematics Department, MIT. Boston, MA.
11/2010	Machine-adapted Methods: High-order DG Wave Propagation on GPUs. Numerical Analysis and Scientific Computing Seminar. Courant Institute, NYU. New York, NY.
10/2010	PyCUDA: Even Simpler GPU Programming with Python. Nvidia GPU Technology Conference. San Jose, CA.
7/2010	High-Order Discontinuous Galerkin Methods by GPU Metaprogramming. 2010 International Workshop of GPU Solutions to Multiscale Problems in Science and Engineering. Harbin, China.
7/2010	Machine-adapted Methods: Shock Detection and Capture in GPU-DG. Minisymposium 1. SIAM Annual Meeting 2010. Pittsburgh, PA.
3/2010	High-Order Discontinuous Galerkin Methods by GPU Metaprogramming. Aerospace Computational Design Laboratory Seminar. Mechanical Engineering, MIT. Boston, MA.

1/2010	High-Order Discontinuous Galerkin Methods by GPU Metaprogramming. Mathematics and Computer Science Division Seminar. Argonne National Laboratory. Chicago, IL.
11/2009	GPU metaprogramming using PyCUDA: methods and applications. GPU@BU project launch workshop. Boston University Center for Computational Science. Boston, MA.
10/2009	High-Order Discontinuous Galerkin Methods and Loop Generation by GPU Metaprogramming. Seminar Departement Mathematik. Universität Basel. Basel, Switzerland.
10/2009	GPU Metaprogramming using PyCUDA: Methods & Applications. Nvidia GPU Technology Conference. San Jose, CA.
10/2009	Programming GPUs with PyOpenCL (Tutorial). Bernstein Center for Computational Neuroscience. Freiburg, Germany.
8/2009	GPU Metaprogramming Applied to High-Order DG and Loop Generation. Frontiers of Geophysical Simulation. Institute for Mathematics Applied to Geosciences. Boulder, CO.
7/2009	GPU Computing: Introduction, Scripting, and Time-domain DG. Advanced Computation Department Seminar. SLAC National Accelerator Laboratory. Menlo Park, CA.
5/2009	Scripting for GPUs (feat. Discontinuous Galerkin Time Domain). Hess Corporation. Houston, TX.
5/2009	Accelerated Computing (Day-long lecture). HPC Summer Institute. Ken Kennedy Institute for Information Technology, Rice University. Houston, TX.
3/2009	High-Productivity Supercomputing: Metaprogramming GPUs. Minisymposium 134. SIAM Conference on Computational Science and Engineering 2009. Miami, FL.
3/2009	PyCUDA and PyUblas: Hybrid HPC in Python made easy. Minisymposium 98. SIAM Conference on Computational Science and Engineering 2009. Miami, FL.
10/2008	High-Order Unstructured Particle-in-Cell Simulation. Mathematics Department Seminar. Southern Methodist University. Dallas, TX.
10/2008	High-Order Unstructured Particle-in-Cell Simulation. Computational & Applied Mathematics Department Seminar. Rice University. Houston, TX.
7/2008	Methods for High-Order Unstructured Particle-in-Cell Simulation. Seminar des Instituts für Aerodynamik und Gasdynamik. Uni Stuttgart. Stuttgart, Germany.

Workshops and Guest Lectures

1/2020	GPUs, Massive Parallelism, and Compute Abstractions. Geilo Winter School in eScience. Stiftelsen for industriell og teknisk forskning (SINTEF), Norway. Geilo, Norway.

12/2019	Guest Lecture, CMDA 3634: Python and GPUs. Virginia Tech. Blacksburg, VA (via videoconference).
6/2016	Building High-Performance Tools with Python (7-hour advanced tutorial). IN2P3 Computing School. École Polytechnique / Laboratoire Leprince-Ringuet / IN2P3. Palaiseau, France.
6/2016	Building High-Performance Tools with Python (3-hour introductory tutorial). Journée LoOPS. INRIA Saclay / Reseau Loops. Palaiseau, France.
12/2015	Domain-Specific Languages to High Performance: Code Generation and Transformation in Python (2-hour introductory tutorial). International Conference on Python for Education and Scientific Computing (SciPy India) '15. IIT Bombay. Mumbai, India.
11/2015	From Description to Code Generation: Building High-Performance Tools in Python (Half-day tutorial – Acceptance rate: 53%. Third-most popular tutorial at SC'15 by registrations, 91 registrants). Supercomputing '15. Austin, TX.
10/2014	PyOpenCL Tutorial (Three-hour tutorial). Computational Science and Engineering Training Series. University of Illinois at Urbana-Champaign. Urbana, IL.
5/2014	Python, numpy, and PyOpenCL (Six-hour tutorial). Tercer Escuela Argentina de GPGPU para Aplicaciones Científicas. Centro Atómico Bariloche, Instituto Balseiro, Universidad Nacional de Cuyo. Bariloche, Argentina.
5/2014	Python, numpy, and PyOpenCL (Six-hour tutorial). Tercer Escuela Argentina de GPGPU para Aplicaciones Científicas. Centro Atómico Bariloche, Instituto Balseiro, Universidad Nacional de Cuyo. Bariloche, Argentina.
4/2012	Time-Domain Computational Electromagnetics using Discontinuous Galerkin Methods (Guest lecture). Computational Electromagnetics. Courant Institute. New York, NY.
8/2011	Easy, Effective, Efficient: GPU Programming in Python with PyOpenCL and PyCUDA (One-day workshop). Simula Research Laboratory. Lysaker, Norway.
8/2011	Easy, Effective, Efficient: GPU Programming in Python with PyOpenCL and PyCUDA (One-day workshop). GPULab, Department for Informatics and Mathematical Modelling, Technical University of Denmark. Lyngby, Denmark.
3/2011	Easy, Effective, Efficient: GPU Programming in Python with PyOpenCL and PyCUDA (Guest lecture). CS264: Massively Parallel Computing. Harvard University. Boston, MA.
1/2011	GPU programming with PyOpenCL and PyCUDA (4 lectures and labs). Pan-American Advanced Studies Institute (PASI) "Scientific Computing in the Americas: the challenge of massive parallelism". Universidad Técnica Federico Santa María. Valparaíso, Chile.
6/2010	Half-day Tutorial on GPU Computing using PyOpenCL. Conference on Scientific Computing in Python (SciPy 2010). Austin, TX.
6/2010	GPU Computing with PyOpenCL (Half-day Tutorial). Conference on Scientific Computing in Python (SciPy 2010). Austin, TX.
3/2010	GPU Computing (Guest lecture, COMP150-06 (Introduction to High Performance Computing: Tools and Algorithms)). Tufts University. Boston, MA.

3/2010	GPU Computing (Guest lecture, APMA2821: Introduction to High Performance Computing: Tools and Algorithms). Brown University. Providence, RI.
10/2009	Scripting GPUs with PyOpenCL. FACETS Code Jam 3. Bernstein Center for Computational Neuroscience, Universität Freiburg. Freiburg, Germany.
5/2009	Accelerated Computing: GPUs, Cell, Larabee (day-long lecture). 2009 HPC Summer Institute. Ken Kennedy Institute for Information Technology, Rice University. Houston, TX.

Teaching

8/2022 – 12/2022	*Scientific Computing Seminar (CS591MH)* Computer Science, UIUC, Urbana, IL
8/2022 – 12/2022	*Numerical Analysis (CS450)* [`https://relate.cs.illinois.edu/course/cs450-f22`] Computer Science, UIUC, Urbana, IL
1/2022 – 5/2022	*Numerical Methods for Partial Differential Equations (CS555)* [`https://relate.cs.illinois.edu/course/cs555-s22`] Computer Science, UIUC, Urbana, IL
8/2021 – 12/2021	*Numerical Analysis (CS450)* [`https://relate.cs.illinois.edu/course/cs450-f21`] Computer Science, UIUC, Urbana, IL
8/2020 – 5/2021	*(Sabbatical leave)*
1/2020 – 5/2020	*Numerical Methods for Partial Differential Equations (CS555)* [`https://relate.cs.illinois.edu/course/cs555-s20`] Computer Science, UIUC, Urbana, IL
8/2019 – 12/2019	*Fast Algorithms and Integral Equations (CS598APK)* [`https://relate.cs.illinois.edu/course/cs598apk-f19`] Computer Science, UIUC, Urbana, IL
1/2019 – 5/2019	*Numerical Analysis (CS450)* [`https://relate.cs.illinois.edu/course/cs450-s19`] Computer Science, UIUC, Urbana, IL
1/2019 – 5/2019	*Scientific Computing Seminar (CS591MH)* [`http://go.cs.illinois.edu/cs591mh`] Computer Science, UIUC, Urbana, IL
8/2017 – 12/2017	*Languages and Abstractions for High-Performance Scientific Computing (CS598APK)* [`https://relate.cs.illinois.edu/course/cs598apk-f18`] Computer Science, UIUC, Urbana, IL
8/2018 – 12/2018	*Scientific Computing Seminar (CS591MH)* [`http://go.cs.illinois.edu/cs591mh`] Computer Science, UIUC, Urbana, IL
1/2018 – 5/2018	*Scientific Computing Seminar (CS591MH)* [`http://go.cs.illinois.edu/cs591mh`] Computer Science, UIUC, Urbana, IL
8/2017 – 12/2017	*Fast Algorithms and Integral Equations (CS598APK)* [`https://relate.cs.illinois.edu/course/cs598apk-f17`] Computer Science, UIUC, Urbana, IL
1/2017 – 5/2017	*Numerical Methods (CS357)* [`https://relate.cs.illinois.edu/course/cs357-s17`] Computer Science, UIUC, Urbana, IL

8/2016 – 12/2016	*Numerical Methods (CS357)* Built up a set of lecture notes for the class, introduced frequent, computer-based 'examlets' (every two weeks) to establish and maintain student proficiency. [`https://relate.cs.illinois.edu/course/cs357-f16`] Computer Science, UIUC, Urbana, IL
1/2016 – 5/2016	*Numerical Analysis (CS450)* Enhanced student experience with interactive, online assignments as well as computer-based exams based on RELATE. [`https://relate.cs.illinois.edu/course/cs450-s16`] Computer Science, UIUC, Urbana, IL
8/2015 – 12/2015	*Fast Algorithms and Integral Equations (CS598APK)* Redeveloped earlier topics class with a more practical, algorithmic focus. Added interactive, online assignments based on RELATE. [`https://relate.cs.illinois.edu/course/cs598apk-f15`] Computer Science, UIUC, Urbana, IL
1/2015 – 5/2015	*Numerical Methods (CS 357)* Computer Science, UIUC, Urbana, IL Developed a new numerics class for undergraduate computer science majors. Developed a new learning platform ('RELATE'), pre-lecture quizzes and videos, auto-graded homework, and in-class activities. (Continued from Fall 2014.) Listed on 'list of teachers ranked as excellent by their students". [`https://relate.cs.illinois.edu/course/cs357-s15/`]
8/2014 – 12/2014	*Numerical Methods (CS 357)* Computer Science, UIUC, Urbana, IL [`https://relate.cs.illinois.edu/course/cs357-f14/`]
1/2014 – 5/2014	*Numerical Analysis (CS 450)* Computer Science, UIUC, Urbana, IL
8/2013 – 12/2013	*Integral Equations and Fast Methods (CS598AK)* Developed a new topics class on fast and accurate use of integral equations as a tool in the solution of PDEs. Lecture video available on class web page. [`http://bit.ly/inteq13`] Computer Science, UIUC, Urbana, IL
9/2012 – 12/2012	*High Performance Computing* (with Marsha Berger) Redeveloped earlier course in a demonstration-based, interactive format. Lecture video available on class web page. [`http://bit.ly/hpc12`] Courant Institute, NYU, New York, NY
1/2012 – 5/2012	Undergraduate *Discrete Mathematics*. Courant Institute, NYU, New York, NY
9/2011 – 12/2011	Undergraduate *Discrete Mathematics*. Courant Institute, NYU, New York, NY
1/2011 – 5/2011	Undergraduate *Discrete Mathematics*. Courant Institute, NYU, New York, NY
9/2010 – 12/2010	*High Performance Computing* (with Marsha Berger) Developed course and taught as an early graduate class. Courant Institute, NYU, New York, NY
3/2005 – 7/2005	Recitation leader for *Numerical Analysis for PDEs* Universität Karlsruhe, Germany (with Vincent Heuveline)

8/2001 – 12/2001	*College Algebra* University of North Carolina at Charlotte

Funding

10/1/2020 – 9/30/2025	*Center for Exascale-enabled Scramjet Design* (member of the executive committee, PI: Jon Freund) Predictive Science Academic Alliance Program (PSAAP, 3rd round), Department of Energy, grant number DE-NA0003963.
1/13/2020 – 1/17/2020	*Fast and Accurate Simulation of Waves in Layered Media* (one week research stay at ICERM, joint with Min-Hyung Cho (UMass) and Jingfang Huang (UNC Chapel Hill)) Collaborate@ICERM workshop grant. Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, RI.
12/10/2019 – 12/9/2020	*Distributed-Memory Layer Potential Evaluation using Accelerated Quadrature By Expansion* XSEDE Startup Allocation TG-ASC190065, SDSC Comet: 50,000.0 SUs. (valued at $932)
10/01/2019 – 9/30/2023	*Elements: Transformation-Based High-Performance Computing in Dynamic Languages* National Science Foundation, Cyberinfrastructure for Sustained Innovation, grant number OAC-1931577. $600k
10/01/2019 – 9/30/2023	*SHF: Small: Collaborative Research: Transform-to-perform: languages, algorithms, and solvers for nonlocal operators* National Science Foundation, CISE Software and Hardware Foundations, grant number SHF-1911019. $320k
9/15/2017 – 9/14/2023	*CAREER: Towards General-Purpose, High-Order Integral Equation Methods for Computer Simulation in Engineering: Analysis, Algorithm Design, and Applications* National Science Foundation, Computational Mathematics Program, grant number DMS-1654756. $400k
12/29/2016 – 5/30/2017	*Workshop grant:* Virtual Institute for Mathematical and Statistical Sciences (VI-MSS): Integral Equation Methods, Fast Algorithms and Their Applications to Fluid Dynamics and Materials Science. (Two two-week workshops with invited graduate students, one at The Hong Kong University of Science and Technology and another at ICERM, joint with Xiao-Ping Wang and Yang Xiang (both HKUST) and Shidong Jiang (NJIT)) Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, RI.
3/8/2015	*Hardware donation* to support numerics and HPC research. (One Nvidia K40 GPU) Nvidia Corporation, Santa Clara, CA.
7/15/2015 – 6/30/2018	*Transform-to-perform: Languages, algorithms, and code transformations for high-performance FEM* National Science Foundation, Computer & Communications Foundations Program, grant number CCF-1524433. (joint with Rob Kirby, Baylor University) $219k (total award: $450k)

9/23/2014 – 6/21/2015	*A Data Model and a Transformation Vocabulary for Partial Differential Equations* Army Research Office STIR grant (under subcontract from Baylor University), contract #32180137-01. (joint with Robert Kirby, Baylor University) $24k (total award: $50k)
8/15/2014 – 8/14/2017	*Efficient High-Order Parallel Algorithms for Large-Scale Photonics Simulation* National Science Foundation, Computational Mathematics Program, grant number DMS-1418961. (lead PI, with Shidong Jiang, NJIT) $210k (total award: $360k)
3/1/2014 – 2/28/2019	*Center for Exascale Simulation of Plasma-Coupled Combustion* (XPACC) at the Coordinated Science Laboratory at the University of Illinois at Urbana-Champaign. National Nuclear Security Administration, Department of Energy. Co-PI (Lead PI: William Gropp, $16M total award amount)
12/1/2013 – 12/31/2016	*NPS-NRL-Rice-UIUC Collaboration on Navy Atmosphere-Ocean Coupled Models on Many-Core Computer Architectures* Office of Naval Research grant number N00014-12-1-0117 (co-PI with Lucas Wilcox, Tim Warburton, Frank Giraldo, and Tim Campbell) $210k (total award: $1,023k)
2010	*Equipment gift* Advanced Micro Devices, Inc.

Students

8/2022 –	Hirish Chandrasekaran, PhD student, Computer Science: *Efficient evaluation of singular layer potentials on domains with corners and edges in two and three dimensions.*
8/2022 –	Addison Alvey-Blanco, PhD student, Computer Science: *Precise polyhedrally-based dependency analysis for GPU code generation with applications in computational science.*
5/2021 –	Mit Kotak. Undergraduate, Engineering Physics: *Eficient execution of array dataflow graphs on GPU hardware.*
5/2019 – 5/2021	Summer Xia, Eunsun Lee. Undergraduates, Computer Science: *Development of a graphical user interface for program transformation.*
5/2019 – 5/2020	Juefei Chen, Feng Hou. Undergraduates, Computer Science: *Development of a graphical user interface for program transformation.*
10/2017 –	Xiaoyu Wei, long-term visitor from the PhD program, Mathematics, Hong Kong University of Science and Technology: *Integral Equation Methods for Material Science and Fast Evaluation of Volume Potentials* , now a postdoctoral researcher in my group.
8/2017 –	Isuru Fernando, PhD candidate, Computer Science: *Symbolic Computation for Accelerated Expansion Mechanisms in the Evaluation of Layer Potentials.*
8/2017 – 9/2020	Hao Gao, PhD candidate, Computer Science: *Layer potential evaluations on distributed memory machines.* First employment: Nvidia.

8/2017 –	Kaushik Kulkarni, PhD candidate, Computer Science: *High-Performance Transformation-Based Code Generation for Finite Element Methods.*
3/2016 – 8/2017	Natalie Beams, PhD defended Jun 13, 2017, Mechanical Science and Engineering: *High-order Hybrid Methods Using Green's Functions and Finite Elements. (co-advised with Luke Olson, Computer Science, UIUC; placement: Postdoctoral Fellow, Department of Computational and Applied Mathematics, Rice University)* First employment: Postdoctoral Researcher at Rice University.
1/2015 – 7/2021	James Stevens, PhD defended Jul 2, 2021, Computer Science: *Program transformation and code generation for developing, modeling, and optimizing GPU programs.*
8/2014 – 8/2017	Shivam Gupta, Undergraduate, Computer Science: *Efficient, topology-based incremental refinement of high-order simplicial meshes.*
8/2014 – 9/2021	Cory Mikida, PhD candidate, Aerospace Engineering: *Multi-rate Time Integration for the Large-Scale Simulation of Plasma-Coupled Combustion (co-advised with Daniel Bodony, Aerospace Engineering)* First employment: Calspan, Inc., Buffalo, NY
1/2014 – 8/2019	Matt Wala, PhD defended Aug 1, 2019, Computer Science: *High-order numerical methods for layer potential evaluation.* First employment: Apple.
10/2012 – 9/2013	Alexander Kaiser, MS Thesis: *Computational Experiments in Markov Chain Monte Carlo.* (NYU, New York, NY) (awarded Courant Institute thesis prize for best MS thesis in the math dept.)
6/2012 – 9/2012	Michael Tom, Undergraduate Research Project: *Computation of Harmonic Vector Fields by High-Order Integral Equation Methods.* (Visiting NYU from Harvard University, Boston, MA)
4/2009 – 10/2009	Andreas Stock, Master's Thesis: *Development and Application of a Multirate Multistep AB Method to a Discontinuous Galerkin Method based Particle In Cell Scheme.* (Visiting Brown University from Universität Stuttgart, Germany)
4/2009 – 10/2009	Hendrik Riedmann, Project Thesis ("Studienarbeit"): *Efficient Numerical Treatment of the Compressible Navier-Stokes Equations with Nodal Discontinuous Galerkin Methods on Graphics Processors.* (Visiting Brown University from Universität Stuttgart, Germany)

Service

Guest Editor	for the following venues: • IEEE Computing in Science & Engineering (Special Issue "Scientific Computing with Python on GPUs and Parallel Systems", Jul./Aug. 2021, Vol. 23, No. 4) • SIAM Journal on Scientific Computing (Special Section on Software in Computational Science and Engineering in conjunction with SIAM CSE '15)
Advisor	Member of the advisory panel, Khronos OpenCL working group (2021–)

Organizer — for the following conferences/workshops:

- Minisymposia 174, 210: "Software and Algorithms for Integral Equations and Boundary Element Methods" (joint with Fruzsina Agocs, Srinath Kailasa, Timo Betcke) SIAM Conference on Computational Science and Engineering 2023, Amsterdam, The Netherlands.
- Parallel Architectures and Compilation Techniques (PACT) 2022, Chicago, IL. General Chair.
- Minisymposia 50, 59, 69: "Flexible, Performance Portable Software for Partial Differential Equations" (joint with Sophia Vorderwuelbecke). SIAM Conference on Parallel Processing for Scientific Computing 2022. Seattle, WA (online).
- Minisymposia 27a, 27b: "Fast and high order solution techniques for boundary integral equations" (joint with Adrianna Gillman) International Conference on Spectral and High-Order Methods (ICOSAHOM) 2020/21. Vienna, Austria (online).
- Track 'High Performance Computing' at SciPy '20, Austin, TX. (co-chairing, joint with Laurie Stephey)
- ARRAY '17 (co-located with PLDI '17), Barcelona, Spain. (co-chairing, joint with David Padua)
- Minisymposium 'Computational Science & Numerical Techniques' at SciPy '17, Austin, TX. (co-chairing, joint with Elizabeth Ramirez)
- ARRAY '16 (co-located with PLDI '16) (organizing/program committee, joint with Clemens Grelck, Martin Elsman (chairs), and David Padua)
- Minisymposia 106, 140: "Computational Scalability and Complex Geometry in Integral Equation Methods" (joint with Adrianna Gillman and Timo Betcke) SIAM Conference on Computational Science and Engineering 2019, Spokane, WA.
- Minisymposia 151, 177, 203, 227: "Software Components for Integral Equation Methods" (joint with Timo Betcke) SIAM Conference on Computational Science and Engineering 2015, Salt Lake City, UT.
- Minisymposia 72, 89, 121: "Integral Equation Methods in Complex Geometry" (joint with Leslie Greengard) SIAM Conference on Computational Science and Engineering 2013, Boston, MA.

Reviewer	for Mathematics and Computers in Simulation (Elsevier), Computer Physics Communications (Elsevier), Journal of Scientific Computing (Springer), Journal of Computational Science (Elsevier), Transactions on Mathematical Software (Association for Computing Machinery), Transactions on Architecture and Code Optimization (Association for Computing Machinery), International Journal of High Performance Computing Applications (SAGE Publications), GPU Computing Gems (Nvidia/Morgan Kaufmann), Journal of Open Source Software, SIAM Journal on Scientific Computing (Society for Industrial and Applied Mathematics), Journal for Computational Physics (Elsevier), International Conference on Spectral and High Order Methods (ICOSAHOM), Comunications in Computer Physics (Elsevier), IEEE Transactions on Parallel and Distributed Systems (IEEE), BIT Numerical Mathematics, DOE Advanced Scientific Computing Research (Funding Proposal Solicitation), Journal of Parallel and Distributed Computing (Elsevier).
Panelist	National Science Foundation (2015, 2017, 2020 $\times$2, 2021)

Program Committee Member

for the following conferences/workshops:

- IMPACT 2023 · 12th International Workshop on Polyhedral Compilation Techniques in conjunction with HiPEAC '23, Toulouse, Francek
- Languages and Compilers for Parallel Computing (LCPC) 2022, Chicago, IL
- Technical Posters Track, Supercomputing '22, Dallas, TX
- IPDPS'19 · 33rd IEEE International Parallel & Distributed Processing Symposium (Regular PC member, Multi-disciplinary track), Rio de Janeiro, Brazil
- IMPACT 2019 · 9th International Workshop on Polyhedral Compilation Techniques
- Supercomputing 2018 · Programming Systems Track, Dallas, TX
- ARRAY'18 ACM SIGPLAN 5th International Workshop on Libraries, Languages and Compilers for Array Programming, Philadelphia, PA
- PACT 2017 · Parallel Architectures and Compilation Techniques (PACT), Portland, OR
- IMPACT 2017 · 7th International Workshop on Polyhedral Compilation Techniques at HiPEAC '17, Stockholm, Sweden
- PyHPC 2016 at Supercomputing '16, Austin, TX
- Technical Posters Track, Supercomputing '16, Salt Lake City, UT
- PyHPC 2015 at Supercomputing '15, Austin, TX
- IEEE International Conference on High Performance Computing, Data and Analytics (HiPC 2015) (Applications area), Bangalore, India
- ARRAY'15 ACM SIGPLAN 2nd International Workshop on Libraries, Languages and Compilers for Array Programming, Portland, OR
- IEEE International Conference on Parallel and Distributed Systems (ICPADS 2014), track "Multicore Computing and Parallel/Distributed Architecture", Hsinchu (Taiwan)
- IEEE International Conference on Parallel and Distributed Systems (ICPADS 2012), track "Multicore Computing and Parallel/Distributed Architecture", Singapore.
- PyHPC 2014 at Supercomputing '14, New Orleans, LA.
- Innovative Parallel Computing ("InPar") 2012, San Jose, CA.
- 4th Workshop on using Emerging Parallel Architectures (WEPA 2012) held at International Conference on Computational Science (ICCS) 2012, Omaha, NE.
- PyHPC 2011 at Supercomputing '11, Seattle, WA.

Doctoral Committee	Matthew Michelotti (Heath, CS, UIUC, ‘14), Yanhua Sun (Kale, CS, UIUC, ‘15), Huan-ting (Joe) Meng (Jin, ECE, UIUC, ‘15), Pradeep Gudla (West, MechSE, UIUC, ‘16), Dhairya Malhotra (Biros, ICES, UT Austin, ‘16), Jian Guan (Jin, ECE, UIUC, ‘17), Ketan Mittal (Fischer, MechSE, UIUC, ‘19), Andrew Reisner (Olson, CS, UIUC ‘19), Sweta Yamini Pothukuchi (Padua, CS, UIUC ‘20, maiden name: Seethamraju), Alexandru Fikl (Bodony, Aerospace Engineering, UIUC, ‘22), Peter Sentz (Olson, CS, UIUC, ‘22), Mert Hidayetoglu (Hwu, ECE, UIUC, ‘22), Pedro Bello-Baldonado (Fischer, CS, UIUC, ‘22), Nicholas Christensen (Fischer, CS, UIUC, ‘23), Malachi Phillips (Fischer, CS, UIUC, ‘23) Thilina Ratnayaka (Fischer, CS, UIUC, ‘23)
Outreach	Faculty Judge for HackIllinois (2015, 2016, 2020 $\times 2$)
Faculty Advisor	SIAM Student Chapter, University of Illinois at Urbana-Champaign
Member	Society for Industrial and Applied Mathematics, Association for Computing Machinery.

Software Packages

pytential	a software package for the asymptotically fast evaluation of layer potentials, used for the fast solution of boundary value problems for elliptic PDEs. Implements my numerical methods and fast algorithms in two and three dimensions. `https://documen.tician.de/pytential`
Loopy	a research software package for code generation on heterogeneous architectures. Active collaborations with the DUNE project (U Heidelberg, finite element code generation), Firedrake project (Imperial College, finite element code generation) as well as numerous others including chemical kinetics and neuroscience. `https://documen.tician.de/loopy`
PyCUDA	a software package to simplify GPU programming in Python. **100th percentile impact** among software on the Python package index, according to depsy.org, an NSF-sponsored index of research software impact measures. 10 releases since 8/2013. 450k direct downloads since 6/2008. `https://documen.tician.de/pycuda`
PyOpenCL	a software package for high-performance scientific computing on heterogeneous architectures, **99th percentile impact** among software on the Python package index, according to depsy.org, an NSF-sponsored index of research software impact measures. 18 releases since 8/2013. 320k direct downloads since 8/2009. `https://documen.tician.de/pycuda`
boxtree	a software package for the shared-memory parallel construction of quadtrees, octrees, associated geometric queries, and interaction traversal structures. `https://documen.tician.de/boxtree`
meshmode	a software package for the high-order unstructured discretization of surfaces and volumes with complex geometry in one, two, and three dimensions. `https://documen.tician.de/meshmode`

islpy	a software package for program transformation in the polyhedral model, **95th percentile impact** among software on the Python package index, according to depsy.org, an NSF-sponsored index of research software impact measures. 15 releases since 8/2013. 69k direct downloads since 7/2011. `https://documen.tician.de/islpy`
pymbolic	a software package for program representation, **95th percentile impact** among software on the Python package index, according to depsy.org, an NSF-sponsored index of software impact measures. 18 releases since 8/2013. 80k direct downloads since 4/2008. `https://documen.tician.de/pymbolic`
Relate	Created and continue to maintain RELATE, a course software platform. Used by me for CS 357, CS 450, CS 598 APK. Used by others for CS 101 (since Fall '15), CS 210 (Fall '15), CS 357 (since Fall '15) CS 450 (since Spring '16), CS 555 (Spring '16), CS 556 (Fall '16), CS 491TC (Since Fall '17), CS 446 (Fall '17), CS 196 (Since Fall '17). Open-source and available at https://github.com/inducer/relate, with numerous outside contributions. Known deployments at Zhejiang University, Southern China University of Technology, Universidad Nacional de Colombia. `https://documen.tician.de/relate`, `https://relate.cs.illinois.edu`
and numerous others	See `https://github.com/inducer`.