Yang Liu

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Research Interests

Scientific Computing: Direct solvers and preconditioners for sparse and dense linear systems, low-rank and butterfly compression, randomized matrix and tensor algorithms, high-performance computing, autotuning, Bayesian optimization, scientific machine learning, as well as their applications to fusion simulation, accelerator modeling, seismic modeling, optical computing, quantum chemistry, quantum computing, bio-science, nuclear physics, power grid and inverse problem applications.

Computational Electromagnetics: Fast integral and differential equation solvers for large-scale electromagnetic problems, multi-resolution algorithms for transient scattering, multi-physics and multi-scale modeling, inverse scattering, and high-frequency ansatz.

Positions

- Career Research Scientist, Lawrence Berkeley National Laboratory, Feb. 2022 - Present
- Career-Track Research Scientist, Lawrence Berkeley National Laboratory, Aug. 2019 - Jan. 2022
- Postdoctoral Fellow, Lawrence Berkeley National Laboratory, Aug. 2017 - Jul. 2019
- Postdoctoral Fellow, University of Michigan, June 2015 - July 2017
- Research Assistant, University of Michigan, Sept. 2010 - May 2015
- Teaching Assistant, Shanghai Jiao Tong University, Mar. 2009 - June 2009

Education

- Ph.D., Electrical Engineering, University of Michigan, May 2015
  Advisor: Eric Michielssen
- M.S., Mathematics, University of Michigan, Nov. 2014
- M.S., Electrical Engineering, University of Michigan, May 2013
- B.S., Electrical Engineering, Shanghai Jiao Tong University, June 2010

Honors and Awards

- LBNL SPOT Award, 2024
- Young Scientists Award, 3rd URSI Atlantic Radio Science Meeting (AT-AP-RASC), 2022
- Sergei A. Schelkunoff Transactions Prize Paper Award, IEEE Antennas and Propagation Society, 2018
- 1^{st} Place in Student Paper Competition, 12th International Workshop on Finite Elements for Microwave Engineering, 2014
- 2^{nd} Place in Student Paper Competition, 28th Annual Review of Progress in Applied Computational Electromagnetics, 2012
- Rackham Travel Grant, University of Michigan, 2012 to 2014
- Outstanding Graduate Award, Shanghai Jiao Tong University, 2010
- Third Prize in National Electronic Contest, China, 2009

Software Development

- **Lead**, ButterflyPACK: https://github.com/liuyangzhuan/ButterflyPACK
- **Lead**, GPTune: https://github.com/gptune/GPTune
- **Lead**, STFNO: https://github.com/liuyangzhuan/STFNO
- **Core developer**, SuperLU_DIST: https://github.com/xiaoyeli/superlu_dist
- **Core developer**, STRUMPACK: https://github.com/pghysels/STRUMPACK

FUNDED PROJECTS

PI, LBNL LDRD: Green's Function Based and Machine Learning Enhanced Algorithms for Solving Vlasov-Maxwell Systems. LBNL annual: $250K. 2022 - 2024

- Develop new first principle and ML algorithms for fusion and accelerator modeling.

Co-PI, DOD-SBIR (Phase I): Sparse Coding-based Sonar Image Compression. LBNL annual: $40K. 2023

- Develop new dictionary learning and linear algebra algorithms for compressing sonar data.

Key-personnel, DOE ASCR: Domain-aware Advanced Gaussian Process Driven UQ for Complex Stochastic Systems. LBNL annual: $1M. 2023 - 2027

- Develop large-scale GPs and uncertainty quantification techniques

Key-personnel, DOE SciDAC: Fundamental Nuclear Physics at the Exascale. LBNL annual: $400K. 2023 - 2027

- Develop multi-color ILU preconditioners for the lattice QCD simulations

Key-personnel, DOE ASCR: SPARSITUTE: A Mathematical Institute for Sparse Computations in Science and Engineering. LBNL annual: $890K. 2023 - 2027

- Develop symmetric pivoting algorithms for sparse LU decomposition
- Develop tensor algorithms for data science and PDEs.

Key-personnel, DOE ASCR: FASTMath: Frameworks, Algorithms, and Scalable Technologies for Mathematics. LBNL annual: $1.5M 2017 - 2027

- Developing butterfly algorithms for solving large-scale sparse and dense matrix systems
- Improve algorithm performance of SuperLU_DIST for fusion codes NIMROD and M3DC1.

Key-personnel, LBNL LDRD: Designing Radio Frequency Cavity with Multi-objective Genetic Algorithm. LBNL annual: $125K. 2020 - 2022

- Develop fast simulators for RF accelerator modeling.

Key-personnel, DOE ECP: STRUMPACK/SuperLU/FFTX: Sparse Direct Solvers, Preconditioners, and FFT Libraries. LBNL annual: $1.5M. 2017 - 2023

- Develop distributed-memory and GPU-accelerated sparse factorization and solve algorithms in SuperLU_DIST and STRUMPACK.

Key-personnel, DOE ECP: The Extreme-scale Scientific SW Development Kit for the Exascale Computing Project: xSDK4ECP. LBNL annual: $250K. 2017 - 2023

- Develop the autotuning package GPTune for exascale DOE applications.

REVIEWER EXPERIENCE

Proposals

- DOE SBIR/STTR proposals
- Dutch Research Council (NWO) proposals
- Israel Science Foundation (ISF) proposals
- LBNL LDRD proposals
- LBNL red team reviewer
- NNSA PATH program

Conference Proceedings

- PC member for IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC) 2024
- PC member for International Parallel and Distributed Processing Symposium (IPDPS) 2023, 2024
- PC member for IEEE Cluster 2021
- PC member for International Conference on Parallel Processing (ICPP) 2021, 2023

- PC member for Supercomputing (SC) 2021, 2022
- IEEE AP-S/URSI Symposium 2021, 2022, 2023
- PC member for SIAM Conference on Parallel Processing for Scientific Computing (PP), 2022, 2023

Journals

- AIP Physics of Plasma
- Communications in Computational Physics
- CCF Transactions on High Performance Computing
- CSIAM Transactions on Applied Mathematics
- Journal of Computational Physics
- ACM Transactions on Mathematical Software
- Applied and Computational Harmonic Analysis
- The Journal of the Acoustical Society of America
- SIAM Journal of Scientific Computing
- SIAM Journal on Matrix Analysis and Applications
- Mathematical Reviews of AMS
- IEEE Transaction on Antennas and Propagation
- IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control
- IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems
- IEEE Antennas and Propagation Magazine
- IEEE Transaction on Microwave Theory and Techniques
- IEEE Transactions on Parallel and Distributed Systems
- IEEE Antennas and Wireless Propagation Letters
- IEEE Journal on Multiscale and Multiphysics Computational Techniques
- International Journal of Numerical Modelling: Electronic Networks, Devices and Fields
- Concurrency and Computation: Practice and Experience
- Journal of Applied Computational Electromagnetics Society
- International Journal of Antennas and Propagation
- The Open Electrical and Electronic Engineering Journal
- Journal of Microwaves, Optoelectronics and Electromagnetic Applications
- Mathematics of MDPI
- Digital Discovery Journal

SESSION ORGANIZER

- Co-chair for the technical program committee, ACES 2025 Conference, 2025
- Chair for "Fast Algorithms," ACES 2024 Conference, May 2024
- Chair for "Fast Algorithms," IEEE NEMO Conference, Aug 2023
- Publication chair for IEEE NEMO Conference, 2023
- Committee Member for "DOE SciDAC FASTMath Seminar Series", 2021, 2022
- Chair for "Low-Rank Compression-Based Fast Sparse Direct Solvers," SIAM Conference on Parallel Processing for Scientific Computing, 2020
- Chair for "Fast and Accurate Integral Methods for Highly Oscillatory Phenomena," SIAM Conference on Computational Science and Engineering, 2019
- Chair for "Time-Domain Computational Methods for Complex Electromagnetic and Multiphysics Problems," IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting, 2019
- Chair for "Parallel Sparse Triangular Solve on Emerging Platforms," SIAM Conference on Applied Linear Algebra, 2018
- Chair for "Acceleration Techniques for Integral Equations," IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting, 2017.
- Chair for "Time-Domain Numerical Methods," IEEE International Symposium on Anten-

nas and Propagation and USNC-URSI Radio Science Meeting, 2012
- Judge for the 10th Annual Engineering Graduate Symposium, University of Michigan, 2015
- Steering Committee for "Celebrating Maxwell's Equations: 150 Years" workshop, 2015.
- Chapter Treasurer for IEEE Southeastern Michigan Section, Chapter IV, 2011-2016.
- Secretary for Technical Activities Committee, IEEE Southeastern Michigan Section, 2015-2016.

BOOK CHAPTERS

[1] **Y. Liu**, and E. Michielssen "Parallel fast time-domain integral-equation methods for transient electromagnetic analysis," in Parallel algorithms in computational science and engineering. Birkhauser, 2020.

PREPRINTS

[1] P. M. Kielstra, T. Shi, H. Luo, J. Qian, and **Y. Liu**, "A linear-complexity tensor butterfly algorithm for compressing high-dimensional oscillatory integral operators," *SIAM J. Multiscale Model Simul.,* (submitted).

[2] M. Rahman, Z. Bai, J. King, C. Sovinec, X. Wei, S. Williams, and **Y. Liu**, "Sparsified time-dependent Fourier neural operators for fusion simulations," *Physics of Plasmas,* (submitted).

[3] S. Ockerman, A. Perez Dieguez, T. Aikman, Y. Cho, **Y. Liu**, and K. Ibrahim, "Parallelizing HPC tuning searches: unveiling the potential of the speculation strategy in Bayesian optimization" *Int. Journal of High Performance Computing Applications,* (submitted).

[4] W. Boukaram, **Y. Liu**, P. Ghysels, and X. S. Li, "Adaptive sketching based construction of H2-matrices on GPUs" *IEEE International Parallel and Distributed Processing Symposium,* (submitted).

[5] N. Ding, B. Austin, **Y. Liu**, N. Mehta, S. Farrell, J. P. Blaschke, L. Oliker, H. A. Nam, N. J. Wright, and S. Williams, "Workflow Roofline Model for End-to-end Workflow Performance Analysis," in *The International Conference for High Performance Computing, Networking, Storage, and Analysis*, (accepted).

REFEREED JOURNAL PUBLICATIONS

[1] T. Shi, Z. Wang, A. Aldossary, **Y. Liu**, X. S. Li, and M. Head-Gordon, "Local second order Møller-Plesset theory with a single threshold using orthogonal virtual orbitals: a distributed memory implementation," *J. Chem. Theory Comput.,* vol. 20, pp. 8010–8023, 2024. doi:10.1021/acs.jctc.4c01016.

[2] W. Boukaram, Y. Hong, **Y. Liu**, T. Shi, and X. S. Li, "Batched sparse direct solver design and evaluation in SuperLU DIST," *Int. Journal of High Performance Computing Applications,* vol. 38, pp. 585-598, 2024. doi:10.1177/10943420241268200.

[3] H. Luo, Y. Cho, J. W. Demmel, X. S. Li, and **Y. Liu**,, "Hybrid models for mixed variables in Bayesian optimization," *Journal of Computational and Graphical Statistics,* vol. 33, pp. 855–868, 2024. doi:10.1080/10618600.2024.2308216.

[4] H. Luo, J. W. Demmel, Y. Cho, X. S. Li, and **Y. Liu**, "Non-smooth Bayesian optimization in tuning problems,"*Int. Journal of High Performance Computing Applications,* vol. 38, pp. 633-657, 2024. doi:10.1177/10943420241278981.

[5] Z. Wang, A. Aldossary, T. Shi, **Y. Liu**, X. S. Li, and M. Head-Gordon, "Local second-order Møller–Plesset theory with a single threshold using orthogonal virtual orbitals: theory, implementation, and assessment," *J. Chem. Theory Comput.,* vol. 19, pp. 7577–7591, 2023. doi:10.1021/acs.jctc.3c00744.

[6] **Y. Liu**, T. Luo, A. Rani, H. Luo, and X. Li, "Detecting resonance of radio-frequency cavities using fast direct integral equation solvers and augmented Bayesian opti-

mization," *IEEE J. Multiscale Multiphysics Comput. Tech.,* vol. 8, pp. 361-371, 2023. doi:10.1109/JMMCT.2023.3311322.

[7] L. Claus, P. Ghysels, **Y. Liu**, T. Nhan, R. Thirumalaisamy, A. P. S. Bhalla, and X. Li, "Sparse approximate multifrontal factorization with composite compression methods," *ACM Trans. Math. Softw.,* vol. 49, pp. 1-28, 2023. doi:10.1145/3611662.

[8] X. Li, **Y. Liu**, P. Lin, and P. Sao, "Newly released capabilities in distributed-memory SuperLU sparse direct solver," *ACM Trans. Math. Softw.,* vol. 49, pp. 1-20, 2023. doi:10.1145/3577197.

[9] W. Sheng, A. C. Yucel, **Y. Liu**, H. Guo, and E. Michielssen, "A domain decomposition based surface integral equation simulator for characterizing EM wave propagation in mine environments," *IEEE Trans. Antennas Propag.,* vol. 71, pp. 5133-5144, 2023. doi:10.1109/TAP.2023.3256579.

[10] **Y. Liu**, J. Song, R. Burridge, and J. Qian, "A fast butterfly-compressed Hadamard-Babich integrator for high-frequency inhomogenous Helmholtz equations in variable media," *SIAM J. Multiscale Model Simul.,* vol. 21, pp. 269-308, 2023. doi:10.1137/21M1450422.

[11] M. Wang, **Y. Liu**, P. Ghysels, and A. C. Yucel, "VoxImp: impedance extraction simulator for voxelized structures," *IEEE Trans. Comput.-Aided Des. Integr. Circuits Syst.,* vol. 42, pp. 2771-2775, 2022. doi:10.1109/TCAD.2022.3218768.

[12] S. B. Sayed, **Y. Liu**, L. J. Gomez, and A. C. Yucel, "A butterfly-accelerated volume integral equation solver for broad permittivity and large-scale electromagnetic analysis," *IEEE Trans. Antennas Propag.,* vol. 70, pp. 3549-3559, 2021. doi:10.1109/TAP.2021.3137193.

[13] **Y. Liu**, P. Ghysels, L. Claus, and X. Sherry Li, "Sparse approximate multifrontal factorization with butterfly compression for high frequency wave equations," *SIAM J. Sci. Comput.,* vol. 43, pp. S367-S391, 2021. doi:10.1137/20M1349667.

[14] **Y. Liu**, Xin Xing, H. Guo, E. Michielssen, P. Ghysels, and X. Sherry Li "Butterfly factorization via randomized matrix-vector multiplications," *SIAM J. Sci. Comput.,* vol. 43, pp. A883-A907, 2021. doi:10.1137/20M1315853.

[15] **Y. Liu**, W. Sid-Lakhdar, E. Rebrova, P. Ghysels, and X. Sherry Li, "A parallel hierarchical blocked adaptive cross approximation algorithm," *Int. Journal of High Performance Computing Applications*, vol. 34, pp. 394-408, 2020. doi:10.1177/1094342020918305

[16] **Y. Liu**, and H. Yang, "A hierarchical butterfly LU preconditioner for two-dimensional electromagnetic scattering problems involving open surfaces," *J. Comput. Phys.*, vol. 401, pp. 109014, 2019. doi:10.1016/j.jcp.2019.109014

[17] H. Guo, **Y. Liu**, J. Hu, and E. Michielssen, "A butterfly-based direct solver using hierarchical LU factorization for PMCHWT equations," *Microw. Opt. Technol. Lett.,* 2018. doi:10.1002/mop.31166

[18] **Y. Liu**, A. C. Yucel, H. Bagci, A. C. Gilbert, and E. Michielssen, "Wavelet-enhanced plane-wave time-domain algorithm for analysis of transient scattering from electrically large conducting objects," *IEEE Trans. Antennas Propag.,* vol. 60, pp. 1381-1387, 2017. doi:10.1109/TAP.2018.2809555

[19] A. C. Yucel, W. Sheng, C. Zhou, **Y. Liu**, H. Bagci, and E. Michielssen, "An FMM-FFT accelerated SIE simulator for analyzing EM wave propagation in mine environments loaded with conductors," *IEEE J. Multiscale and Multiphys. Comput. Techn.,* vol. 3,

pp. 3-15, 2017. doi:10.1109/JMMCT.2018.2802420.

[20] **Y. Liu**, H. Guo, and E. Michielssen, "A HSS matrix-inspired butterfly-based direct solver for analyzing scattering from two-dimensional objects," *IEEE Antennas Wireless Propag. Lett.*, vol. 16, pp. 1179-1183, 2017. doi:10.1109/LAWP.2016.2626786

[21] H. Guo, **Y. Liu**, J. Hu, and E. Michielssen, "A butterfly-based direct integral equation solver using hierarchical LU factorization for analyzing scattering from large conducting objects," *IEEE Trans. Antennas Propag.,* vol. 65, pp. 4742-4750, 2017. doi:10.1109/TAP.2017.2727511

[22] **Y. Liu**, A. Al-Jarro, H. Bagci, and E. Michielssen, "Parallel PWTD-accelerated explicit solution of the time domain electric field volume integral equation," *IEEE Trans. Antennas Propag.,* vol. 64, pp. 2378-2388, 2016. doi:10.1109/TAP.2016.2546964

[23] **Y. Liu**, A. C. Yucel, H. Bagci, and E. Michielssen, "A scalable parallel PWTD-accelerated surface integral equation solver for analysis of transient scattering from large-scale objects," *IEEE Trans. Antennas Propag.,* vol. 64, pp. 663-674, 2016. doi:10.1109/TAP.2015.2508483

[24] **Y. Liu**, A. C. Yucel, V. Lomakin, and E. Michielssen, "Graphics processing unit implementation of multilevel plane-wave time-domain algorithm," *IEEE Antennas Wireless Propag. Lett.,* vol. 13, pp. 1671-1675, 2014. doi:10.1109/LAWP.2014.2350967

[25] A. C. Yucel, **Y. Liu**, H. Bagci, and E. Michielssen, "Statistical characterization of electromagnetic wave propagation in mine environments," *IEEE Antennas Wireless Propag. Lett.,* vol. 12, pp. 1602-1605, 2013. doi:10.1109/LAWP.2013.2293288

PROCEEDINGS PAPERS

[1] Y.-K Kan, X. Li, **Y. Liu**, J. Qiang, X. Gu, W. Fung, and Y. Hao, "Advanced modeling and optimization of nuclear physics colliders," in *15th International Particle Accelerator Conference*, pp. 3194-3197, 2024. doi:10.18429/JACoW-IPAC2024-THPC72

[2] **Y. Liu**, N. Ding, P. Sao, S. Williams, and X. S. Li, "Unified communication optimization strategies for sparse triangular solver on CPU and GPU clusters," in *The International Conference for High Performance Computing, Networking, Storage, and Analysis*, pp. 1-15, 2023. doi:10.1145/3581784.3607092

[3] .G Dinh, I. Valsala, H. Luo, C. Hong, Y. Cho, J. Demmel, X. S. Li, and **Y. Liu**, "Sample-efficient mapspace optimization for DNN accelerators with Bayesian learning," in *Architecture and System Support for Transformer Models*, pp. 1-15, 2023. doi:10.1145/3581784.3607092

[4] Y. Cho, J. W. Demmel, J. King, X. S. Li, **Y. Liu**, and H. Luo, "Harnessing the crowd for autotuning high-performance computing applications," in *IEEE International Parallel and Distributed Processing Symposium*, pp. 635-645, 2023. doi:10.1109/IPDPS54959.2023.00069

[5] **Y. Liu**, "A comparative study of butterfly-enhanced direct integral and differential equation solvers for high-frequency electromagnetic analysis involving inhomogeneous dielectrics," in *3rd URSI Atlantic Radio Science Meeting (AT-AP-RASC)*, pp. 1-4, 2022. doi:10.23919/AT-AP-RASC54737.2022.9814197

[6] X. Zhu, **Y. Liu**, P. Ghysels, D. Bindel, and X. S. Li, "GPTuneBand: multi-task and multi-fidelity Bayesian optimization for autotuning exascale applications," in *SIAM PP*, pp. 1-13, 2022. doi:10.1137/1.9781611977141.1

[7] Y. Cho, J. W. Demmel, X. S. Li, **Y. Liu**, and H. Luo, "Enhancing autotun-

ing capability with a history database," in *IEEE 14th International Symposium on Embedded Multicore/Many-core Systems-on-Chip (MCSoC)*, pp. 249-257, 2021. doi:10.1109/MCSoC51149.2021.00044

[8] **Y. Liu**, W. M. Sid-Lakhdar, O. Marques, X. Zhu, C. Meng, J. W. Demmel, and X. S. Li. "GPTune: multitask learning for autotuning exascale applications," in *PPoPP21*, pp. 234–246, 2021. doi:10.1145/3437801.3441621

[9] N. Ding, S. Williams, **Y. Liu** and X. S. Li "A message-driven, multi-GPU parallel sparse triangular solver," in *SIAM ACDA*, pp. 147-159, 2021. doi:10.1137/1.9781611976830.14

[10] G. Chavez, E. Rebrova, **Y. Liu**, P. Ghysels and X. S. Li "Scalable and memory-efficient kernel ridge regression," in *34th IEEE International Parallel and Distributed Processing Symposium*, pp. 956-965, 2020. doi:10.1109/IPDPS47924.2020.00102

[11] N. Ding, S. Williams, **Y. Liu** and X. S. Li "Leveraging one-sided communication for sparse triangular solvers," in *SIAM Workshop on Combinatorial Scientific Computing,* pp. 93-105, 2020. doi:10.1137/1.9781611976137.9

[12] **Y. Liu**, M. Jacquelin, P. Ghysels, and X. S. Li, "Highly scalable distributed-memory sparse triangular solve algorithms," in *SIAM Workshop on Combinatorial Scientific Computing,* pp. 87-96, 2018. doi:10.1137/1.9781611975215.9

[13] E. Rebrova, G. Ghavez, **Y. Liu**, P. Ghysels, and X. S. Li, "A study of clustering techniques and hierarchical matrix formats for kernel ridge regression," in *Proc. IEEE IPDPSW,* pp. 883-892, 2018. doi:10.1109/IPDPSW.2018.00140

[14] **Y. Liu**, V. Lomakin, and E. Michielssen, "Graphics processing unit-accelerated implementation of the plane wave time domain algorithm," *28th Ann. Rev. Prog. Appl. Computat. Electromagn.,* pp. 1-6, 2012. https://bit.ly/48yFezr

[15] J. Liang, **Y. Liu**, W. Zhang, Y. Xu, X. Gan, and X. Wang, "Joint compressive sensing in wideband cognitive networks," in *IEEE WCNC,* pp. 1-5, 2010. doi:10.1109/WCNC.2010.5506392

SELECTED PRESENTATIONS

[1] "Green's Function-based Methods for Modeling Electromagnetic Interaction Between RF Accelerator Cavity and Electron Bunch", **invited talk**, in *14th International Computational Accelerator Physics Conference*, 2024.

[2] "Recent Algorithm Developments in the ButterflyPACK Package", in *ACES Conference*, 2024.

[3] "Augmenting Linear Solvers in Fusion Codes with Neural Operators", in *Preconditioning Conference*, 2024.

[4] "Efficient Fourier Neural Operators for Fusion Simulations", in *NIMROD Team Meeting*, 2024.

[5] "Fast Iterative Solvers in Tensor Butterfly Format", in *18th Copper Mountain Conference on Iterative Methods*, 2024.

[6] "Butterfly Algorithms: from Matrix to Tensor", in *SIAM Conference on Parallel Processing for Scientific Computing*, 2024.

[7] "Efficient Matrix, Tensor, Machine Learning Algorithms for Computational Science and Engineering Applications", **invited talk**, in *Purdue University Seminar, and Santa Clara University Seminar*, 2024.

[8] "Unified Communication Optimization Strategies for Sparse Triangular Solver on CPU

and GPU Clusters", in *SC23*, 2023.

[9] "Butterfly-compressed Hadamard-Babich Integrator for High-Frequency Helmholtz and Maxwell Equations in Inhomogeneous", in *ICIAM*, 2023.

[10] "Multi-Scale Modeling of RF Cavity Resonance with Fast Direct Solvers and Bayesian Optimization", in *IEEE NEMO Conference*, 2023.

[11] "Babich Ansatz: a Geometrical-Optics-Like Ansatz for Green's Function of Wave Equations with Variable Coefficients", **invited talk**, in *DOE FASTMath Seminar*, 2023.

[12] "Progress on Faster Butterfly Construction Based on Randomized Matrix-Vector Multiplication", in *SIAM CSE*, 2023.

[13] "Fast Direct Solvers for Electromagnetic, Optics, Acoustic, and Elastic Applications", **invited talk**, in *International Conference on Physics and its Applications*, 2022.

[14] "Butterfly Compressed Babich Integrator for Solving Helmholtz Equations in Inhomogeneous Media", **invited talk**, in *BIRS-CMO Workshop on Outstanding Challenges in Computational Methods for Integral Equations*, 2022.

[15] "Fast Direct Integral and Differential Equation Solvers for Electromagnetic, Acoustic, and Elastic Applications at All Frequency Ranges", **invited talk**, in *Howard University, Michigan MICDE, UC Berkeley, and Flatiron Seminars*, 2021.

[16] "Autotuning HPC and ML Applications Using GPTune", **invited talk**, in *Google Research Seminar*, 2021.

[17] "Butterfly-based Hierarchically Semi-separable Matrix for Integral Equation Solvers", in *URSI GASS*, 2021.

[18] "Optimal-Complexity Butterfly Algorithm Based on Randomized Matvec", in *SIAM CSE*, 2021.

[19] "A Fast Direct IE Solver for Characterization of Accelerator Cavities with Waveguide Ports", in *ICCEM*, 2020.

[20] "Butterfly-based Multifrontal Preconditioner for Wave Equations", in *HPC China*, 2020.

[21] "Multitask Learning and Multi-Armed Bandit-Based Bayesian Optimization for HPC Applications", in *NYSDS*, 2020

[22] "Parallel butterfly-based Sherman–Morrison–Woodbury inversion," in *SIAM Conference on Parallel Processing for Scientific Computing,* 2020.

[23] "A blocked adaptive cross approximation algorithm and its hierarchical generalization," in *Copper Mountain Conference On Multigrid Methods,* 2019.

[24] "Enhancing scalability of parallel sparse triangular solve in SuperLU," in *SIAM Conference on Applied Linear Algebra,* 2018.

[25] "Parallel butterfly-based direct solvers for highly oscillatory problems," in *SIAM Conference on Parallel Processing for Scientific Computing,* 2018.

[26] "A HSS-type butterfly-based direct integral equation solver for 3D perfect electrically conducting objects," in *IEEE Int. Symp. AP-S/URSI,* 2017.

[27] "A new MLMDA-based direct integral equation solver for electrically perfect conducting objects," in *IEEE Int. Symp. AP-S/URSI,* 2016.

[28] "A wavelet-based PWTD algorithm-accelerated time domain surface integral equation solver," in *IEEE Int. Symp. AP-S/URSI,* 2015.

[29] "Parallel time domain solvers for electrically large transient scattering problems," **invited talk**, in *EUCAP,* 2014.

[30] "Solving very large scattering problems using a parallel PWTD-enhanced surface integral equation solver," in *IEEE Int. Symp. AP-S/URSI,* 2013.

[31] "Parallel, explicit, and PWTD-enhanced time domain volume integral equation solver," in *IEEE Int. Symp. AP-S/URSI,* 2013.

[32] "A scalable parallel implementation of the plane wave time domain algorithm on graphics processing unit-augmented clusters," in *IEEE Int. Symp. AP-S/URSI,* 2012.

TUTORIALS PRESENTED

[1] "Direct solvers for sparse and dense systems in electromagnetics and multiphysics simulations.", Short course in *ACES Conference*, May 2024

[2] "Rank-structured fast direct solvers for electromagnetics and multiphysics simulations.", Short course in *IEEE NEMO Conference*, June 2023

[3] "SuperLU and STRUMPACK: GPU accelerated sparse factorization solvers", Tutorial in *Exascale Computing Project Annual Meeting*, May. 2023

[4] "Autotuning ECP Codes Using the GPTune Package", Tutorial in *Exascale Computing Project Annual Meeting*, May. 2023

[5] "GPU Capable Sparse Direct Solvers", Tutorial in *Exascale Computing Project Annual Meeting*, May. 2022

[6] "Performance Autotuning of ECP Applications with Gaussian Process-Based and Cloud Database-Enhanced GPTune Package", Tutorial in *Exascale Computing Project Annual Meeting*, May. 2022

[7] "GPTune: Performance Autotuner for ECP Applications", Tutorial in *Exascale Computing Project Annual Meeting*, Apr. 2021

[8] "STRUMPACK / SuperLU: fast parallel direct linear solvers and preconditioners", Tutorial in *Exascale Computing Project Annual Meeting*, Feb. 2020

[9] "Fast parallel direct linear solvers and preconditioners", Tutorial in *SC19*, Nov. 2019

[10] "Scalable direct solvers for electromagnetics and multiphysics simulations.", Short course in *IEEE NEMO Conference*, May 2019