Brian MacKie-Mason <bmackiemason@anl.gov>

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EDUCATION

Doctor of Philosophy Electrical Engineering *2018*
University of New Mexico, **Advisor**: Professor Zhen Peng
Novel Algorithms for Ultra Scale Electromagnetic Problems in the Supercomputing Era

Master of Science Nuclear Engineering *2013*
University of Wisconsin-Madison

Bachelor of Science in Engineering Nuclear Engineering *2011*
University of Michigan

JOURNAL PUBLICATIONS

1. **B. MacKie-Mason**, Y. Shao, A. Greenwood, and Z. Peng, "Supercomputing-Enabled First-Principles Analysis of Radio Wave Propagation in Urban Environments," *IEEE Transactions on Antennas and Propagation,* **66**, pp. 6606–6612 (2018). doi:10.1109/TAP.2018.2874674.
2. Z. Peng, R. Hiptmair, Y. Shao, **B. MacKie-Mason**, "Domain Decomposition Preconditioning for Surface Integral Equations in Solving Challenging Electromagnetic Scattering Problems," *IEEE Transactions on Antennas and Propagation,* **64**, pp. 210–223 (2016). doi:10.1109/TAP.2015.2500908.
3. **B. MacKie-Mason**, A. Greenwood, and Z. Peng, "Adaptive and Parallel Surface Integral Equation Solvers for Very Large-Scale Electromagnetic Modeling and Simulation (invited paper)," *Progress in Electromagnetics Research,* **154**, pp. 143–162 (2015). doi:10.2528/PIER15113001.

CONFERENCE PUBLICATIONS

1. S. Wang, **B. Mackie-Mason**, and Z. Peng, "Platform-Aware In-Situ Antenna and Metamaterial Analysis and Design," *International Review of Progress in Applied Computational Electromagnetics (ACES),* Miami, Florida, USA, April 14–18, 2019. (Best Student Paper Award).
2. **B. MacKie-Mason** and Z. Peng, "Towards Real-time In-Situ Antenna Analysis and Design on Platforms of 1000 Wavelengths", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting,* San Diego, CA, July 9–14, 2017. doi:10.1109/APUSNCURSINRSM.2017.8072714.
3. Z. Peng and **B. MacKie-Mason**, "High-Performance Surface Integral Equation Solvers Towards Extreme-Scale Electromagnetic Modeling and Simulation," *IEEE International Conference on Wireless Information Technology and Systems (ICWITS) and Applied Computational Electromagnetics (ACES),* Honolulu, HI, 22–26, March 2016. doi:10.1109/ROPACES.2016.7465365.
4. **B. MacKie-Mason** and Z. Peng, "Adaptive, Scalable Domain Decomposition Methods for Surface Integral Equations," *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting,* Vancouver, B.C., July 19–25, 2015. doi:10.1109/APS.2015.7305220.

CONTRIBUTED ABSTRACTS

1. **B. MacKie-Mason**, P. Velesko, R. Hager, C.-S. Chang, and T.J. Williams, "Application Study of Gyrokinetic PIC codes on Intel KNL architecture", *IXPUG Annual Fall Conference,* Hillsboro, OR, U.S.A. September 25–28, 2018. https://goo.gl/iLGnTv.
2. **B. MacKie-Mason** and Z. Peng, "Towards a Real-Time Solution of Extreme-Scale Electromagnetic Problems", *National Radio Science Meeting,* Boulder, CO, U.S.A., January 4–7, 2017. https://goo.gl/bK4wms.
3. **B. MacKie-Mason** and Z. Peng, "High-fidelity, High-performance Integral Equation Solver for Time-Harmonic Maxwell's Equations", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting,* Fajardo, Puerto Rico, U.S.A., June 26–July 1, 2016. https://goo.gl/fgmgvk.
4. Z. Peng and **B. MacKie-Mason**, "Integral equation discontinuous Galerkin methods for time harmonic electromagnetic wave problems," *International Review of Progress in Applied Computational Electromagnetics (ACES),* Williamsburg, VA, March 22–26, 2015. https://goo.gl/dkiiyX.

POSTERS

1. E. D'Azevedo, A. Scheinberg, M. Shephard, P. Worley, S. Sreepathi, **B. MacKie-Mason**, T.J. Williams, and the SciDAC HBPS XGC Team, "Performance Enhancements of XGC", *2019 Scientific Discovery through Advanced Computing Principal Investigator (PI) Meeting,* July 16–18, 2019.
2. **B. MacKie-Mason** and XGC Team, "Performance Portability of XGC code at DOE supercomputing facilities", *DOE Performance, Portability and Productivity Annual Meeting,* Apr. 2–4, 2019. https://bit.ly/2UHXMda.
3. **B. MacKie-Mason**, P. Velesko, R. Hager, C.-S. Chang, and T.J. Williams, "Performance Optimization of the XGC code on KNL architecture", *Annual Meeting of the APS Division of Plasma Physics,* Nov. 5–9, 2018. https://goo.gl/wirgSu.
4. **B. MacKie-Mason**, Z. Peng, and C. Kung, "Extreme Fidelity Computational Electromagnetic Analysis in the Supercomputer Era", *The International Conference for High Performance Computing, Networking, Storage and Analysis,* Salt Lake City, Utah, U.S.A., November 13–18, 2016. https://goo.gl/jeQSKR.
5. **B. MacKie-Mason**, W. Tang, "Modeling of laser-induced field emission", *Air Force Research Lab Annual Scholar Presentation,* Albuquerque, NM, July 2013.
6. **B. MacKie-Mason**, N. Lockwood, W. Tang, "Development of single-walled nanotube fiber cathode diagnostics", *Air Force Research Lab Annual Scholar Presentation,* Albuquerque, NM, July 2012.
7. **B. MacKie-Mason**, A. Greenwood, N. Lockwood, "Automated Testing of ICEPIC", *Air Force Research Lab Annual Scholar Presentation,* Albuquerque, NM, July 2011.

OTHER

1. **B. MacKie-Mason** and XGC Team, "Porting XGC to Aurora", *A21 Apps Working Group Meeting,* Argonne National Laboratory, IL, U.S.A., April 19, 2019.
2. **B. MacKie-Mason**, "What Can KNL Do For You?", *CoPA Workshop on Deep-dive into XGC,* Princeton Plasma Physics Laboratory, NJ, U.S.A., Dec. 11–12, 2018. https://bit.ly/2MH3OFT.
3. **B. MacKie-Mason**, "What do I do?", *Argonne Computing Coffee & Code,* Argonne National Laboratory, IL, U.S.A., September 12, 2018. https://goo.gl/AtWQSD.

4. **B. MacKie-Mason** and Z. Peng, "Adaptive and parallel surface integral equation solvers for very large-scale electromagnetic modeling and simulation," *Electrical and Computer Engineering Student Paper Competition,* Albuquerque, NM, April 2016. https://goo.gl/aK2KUn.

TECHNICAL SKILLS

- Algorithm Development, Parallel Computing, Electromagnetic Analysis, MPI, OpenMP, Domain Decomposition Methods, Surface Integral Equation Methods, College Instruction, Scientific Computing, Particle-in-Cell
- Languages: Fortran, C/C++, MATLAB, Bash shell, Python
- Programming Models: MPI, OpenMP, (some) OpenACC
- Software Packages: Intel VTUNE Amplifier, Intel Advisor, ViSiT, CUBIT, MCNP/X SolidWorks (CAD) KDevelop, Improved Concurrent Electromagnetic Particle-in-Cell (ICEPIC)
- HPC Platforms: Theta (ALCF), Cori-KNL (NERSC), JLSE (ALCF), Bebop (ANL), Mira (ALCF), Ulam (UNM), Summit (OLCF), Titan (OLCF), Excalibur (ARL), Topaz (ERDC)
- μArchitectures: Intel KNL, Intel's next generation

PROFESSIONAL EXPERIENCE

Postdoctoral Appointee *March 2018 - Present*
Leadership Computing Facility, Argonne National Laboratory

- Optimize code for Intel KNL architecture. 30% speed-up acheived on target kernel.
- Expert in electron push routine for codebase. 70% of computational time.
- Investigate portability and suitability of code for Aurora.
- Present research findings at inter/national conferences and meetings.
- Argonne Training Program for Extreme-Scale Computing (ATPESC) 2019 participant.

Research Assistant *Fall 2013 - Spring 2018*
Department of Electrical and Computer Engineering, University of New Mexico
Prof. Zhen Peng

- Researched and developed a geometry-aware domain decomposition (GA-IE-DDM) method for the integral solution to extreme-scale, multi-scale electromagnetics problems.
- Developed tools to integrate many different solvers and post-processing techniques to aid in the solution of different types of antenna problems.
- Parallelized GA-IE-DDM in distributed memory environment for a scalable solution method to the Electric Field Integral Equation.
- Developed a model order reduction technique for solving electromagnetic radiation problems when many antennas are mounted on very large PEC platforms.

Research Assistant *Summers 2011-13*
Air Force Research Lab, Kirtland AFB
Computational Electromagnetics
Drs. Wilkin Tang, Nathaniel Lockwood & Andrew Greenwood

- Studied the effects of laser-induced field emission (2013), designed diagnostics to improve the study of field emission (2012), and designed validation and verification test suite for ICEPIC (2011).
- Security clearance active through 2022.

Professional Service

Margaret Butler Review Committee	*March 2019*
INCITE Computational Readiness Review Committee	*2019*
Career Mentoring to High School Students	*2018-19*
International Journal of Antennas and Propagation	*Reviewer*
Waves in Random and Complex Media	*Reviewer*

Awards & Honors

- UNM Leadership and Involvement Award, 2018.
- GPSA President's Award for Innovative Leadership, 2017.
- ECE Outstanding Graduate Student, 2017.
- ECE Graduate Student Association Student Paper Competition – Journal Paper Section, 3rd prize, 2016.
- Eagle Scout, February 2007.

Departmental Service

UNM GPSA *Fall 2015 - Present*

- Graduate & Professional Student Association (GPSA) Alternate Representative to Student Fee Review Board (July 2017 - Present)
- Department of ECE Delegate (August 2015 - May 2016, August 2016 - May 2017)
- GPSA Finance Committee Member (August 2016 - May 2017)
- GPSA Representative to Information Technology UseCommittee (August 2015 - May 2016)
- GPSA Legislative Steering Committee Member-at-large (February 2016 - May 2016)

ECE Graduate Student Association (GSA) *Fall 2015 - Spring 2017*

- ECE GSA Vice-President (June 2016 - May 2017)