

Brian MacKie-Mason <bmackiemason@anl.gov>

<http://brianmackiemason.com>

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** and Z. Peng, "Rapid Antenna Prototyping on Large Platforms via Data-Sparse Schur Complement," [Working].
2. **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](https://doi.org/10.1109/TAP.2018.2874674).
3. 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](https://doi.org/10.1109/TAP.2015.2500908).
4. **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](https://doi.org/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). <https://bit.ly/2VuzVgy>
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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1109/APS.2015.7305220).

CONTRIBUTED ABSTRACTS

1. Aaron Scheinberg, **B. MacKie-Mason**, S. Ethier, G. Chen, S. Slattery, R. Bird, E. D’Azevedo, CS Chang, et. al., “XGC”, *Preparing Applications for Aurora at the Exascale Computing Project Annual Meeting*, Houston, TX, U.S.A. February 3–7, 2020. <https://bit.ly/2KsYdRV>
2. **B. MacKie-Mason** and XGC Team, “Early OpenMP Experience with Collision Kernel”, *OpenMP BOF at the Exascale Computing Project Annual Meeting*, Houston, TX, U.S.A. February 3–7, 2020. <https://bit.ly/2zqN3uB>
3. **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>.
4. **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>.
5. **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>.
6. 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/dkiyX>.

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. <https://bit.ly/3ayDYwC>
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. [Poster Unavailable].
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. [Poster Unavailable].
7. **B. MacKie-Mason**, A. Greenwood, N. Lockwood, “Automated Testing of ICEPIC”, *Air Force Research Lab Annual Scholar Presentation*, Albuquerque, NM, July 2011. [Poster Unavailable].

OTHER

1. **B. MacKie-Mason** and XGC Team, “Porting XGC to Aurora”, *A2I Apps Working Group Meeting*, Argonne National Laboratory, IL, U.S.A., April 19, 2019. [Presentation Unavailable Until Aurora is Stood Up].
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

- **Academic**: Algorithm Development, High Performance Computing, Electromagnetic Analysis, Domain Decomposition Methods, Surface Integral Equation Methods, Scientific Computing, Particle-in-Cell
- **Languages**: Fortran, C/C++, MATLAB, Bash shell, Python
- **Programming Models**: MPI, OpenMP, (some) OpenACC
- **Software Packages**: ViSiT, CUBIT, KDevelop, SolidWorks (CAD), Intel VTUNE Amplifier
- (Well-known) **Research Codes**: Improved Concurrent Electromagnetic Particle-in-Cell (ICEPIC), X-Point Gyrokinetic Code
- **HPC Platforms**: Theta (ALCF), Cori-KNL (NERSC), JLSE (ALCF), Bebop (ANL), Mira (ALCF), Ulam (UNM), Summit (OLCF), Titan (OLCF), Excalibur (ARL), Topaz (ERDC)
- **μ Architectures**: Intel KNL, Intel’s next generation

RESEARCH EXPERIENCE

Senior Research Scientist, Computational Electromagnetics

April 2020 - Present

[Lockheed Martin Aeronautics](#)

[Skunk Works](#)

George Burchuk

Postdoctoral Appointee, Computational Plasma Physics

March 2018 - March 2020

[Leadership Computing Facility](#)

[Argonne National Laboratory](#)

Timothy J. Williams

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

Research Assistant, Computational Electromagnetics
Electrical and Computer Engineering
University of New Mexico

Fall 2013 - Spring 2018

Professor 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, Computational Electromagnetics
Air Force Research Lab
Directed Energy Directorate

June 2013 - August 2013

Wilkin Tang

- Designed and analyzed input decks for laser-induced field emission in ICEPIC.
- Participated in the improvement of computational tools available to the research group.
- Presented research at laboratory symposium to other research scientists.

Research Assistant, Computational Electromagnetics
Air Force Research Lab
Directed Energy Directorate

June 2012 - August 2012

Nathaniel Lockwood

- Designed diagnostics for field emission devices using simulation.
- Participated in the improvement of computational tools available to the research group.
- Presented research at laboratory symposium to other research scientists.

Research Assistant, Computational Electromagnetics
Air Force Research Lab
Directed Energy Directorate

May 2011 - August 2011

Andrew Greenwood

- Converted scripts from C-shell to Python for the ICEPIC test suite.
- Designed Monte Carlo collision plasma tests for the ICEPIC test suite.
- Presented poster at Directed Energy Conference, August 2011.
- Presented research at laboratory symposium to other research scientists.

Lab Assistant, Nuclear Materials
Nuclear Engineering & Radiological Sciences
University of Michigan

May 2009 - August 2009

Professor Gary Was

- Wrote MATLAB programs to smooth data and extract empirical modeling equations.
- Made schematic drawings of laboratory equipment using SolidWorks.
- Prepared for and attended lab group meetings.

Undergraduate Research Assistant, Information Sciences

March 2008 - May 2009

[School of Information](#)

[University of Michigan](#)

Professor Yan Chen

- Conducted human subject computer laboratory experiments.
- Studied trends of Facebook start-up using SQL.

Lab Assistant, Information Sciences

March 2008 - May 2009

[School of Information](#)

[University of Michigan](#)

Professor Yan Chen

- Assisted graduate students in their human subject computer laboratory experiments.
- Recruited subjects for experiments.
- Edited instructions for experiments.

REU Student, Information Sciences

May 2008 - July 2008

[School of Information](#)

[University of Michigan](#)

Professor Yan Chen

- Investigated trends of Facebook start-up (urTurn.com) using SQL.
- Made a research presentation on urTurn.com.
- Attended career training seminars.

Lab Assistant

May 2007 - August 2007

[Department of Chemistry](#)

[University of Michigan](#)

Professor Penner-Hahn

- Improved upon MATLAB algorithm that imaged microscopic worms.
- Assisted in series of experiments at Argonne National Laboratory.

Lab Assistant

June 2006 - July 2006

[Department of Biology](#)

[University of Michigan](#)

Professor Sherman

- Prepared ocean floor samples for discovery of possible bacteria strains.
- Assisted graduate students in preparing laboratory experiments.

TEACHING EXPERIENCE

Graduate Teaching Assistant

August 2014 - December 2014

[Department of Electrical & Computer Engineering](#)

[University of New Mexico](#)

- [ECE 561: Engineering Electrodynamics](#). Provided selected lectures.
- [ECE 555: Foundations of Engineering Electromagnetics](#). Provided selected lectures.
- [ECE 563: Computational Electromagnetics](#). Provided selected lectures.
- [ECE 360: Introduction to Electromagnetics](#):
 - Graded bi-weekly homework assignments.
 - Prepared and held weekly office hours.
 - Provided selected lectures.

- [ECE 131: Programming Fundamentals:](#)
 - Graded bi-weekly homework assignments.
 - Prepared for and held weekly office hours.

Graduate Teaching Assistant, [EMA 201: Statics](#)

January 2012 - May 2013

[Department of Engineering Physics](#)

[University of Wisconsin-Madison](#)

- Prepared and taught two or three hours of discussion section each week.
- Held weekly office hours.
- Graded tests and assignments.
- Participated in bi-weekly planning sessions with other teaching assistants and lead instructor.

Teaching Assistant, Calculus

September 2006 - January 2007

[Department of Mathematics](#)

[Pioneer High School, Ann Arbor](#)

Laurie Hochrein

- Graded extra credit assignments.
- Taught lessons on selected topics.
- Answered student questions.

Math Tutor

January 2006 - May 2006

- Provided tutoring for two middle school students in mathematics.
- Developed curriculum for tutoring sessions.

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

PROFESSIONAL SOCIETIES

[IEEE](#)

2015 - 2018

[SIAM](#)

2016 - 2018

[APS](#)

2018 - 2019

CLEARANCES

[Department of Defense Secret](#)

2012-2022

AWARDS & HONORS

- [UNM Leadership and Involvement Award](#), 2018.
- [GPSA President's Award for Innovative Leadership](#), 2017.
- [ECE Outstanding Graduate Student](#), 2017.
- [Who's Who](#) Among American Colleges & Universities, 2017.
- [ECE GSA Student Paper Competition – Journal Paper Section](#), 3rd prize, 2016.
- [Eagle Scout](#), February 2007.
- Michigan Peace Prize, January 2007.

OTHER EXPERIENCE

UNM GPSA

Fall 2015 - May 2018

- GPSA Alternate Representative to [Student Fee Review Board](#) (July 2017 - May 2018)
- [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 Committee](#) (August 2015 - May 2016)
- [Legislative Steering Committee](#) Member-at-large (February 2016 - May 2016)
- Organized first annual department-wide student paper competition.
- Helped arrange for a regular meeting room within the department.

UNM ECE Graduate Student Association (GSA)

Fall 2015 - May 2017

- ECE GSA [Vice-President](#) (June 2016 - May 2017)
- ECE GSA [Volunteer Member](#) (August 2015 - May 2016)

Alpha Sigma Phi

Fall 2007 - Present

- [Grand Chapter Advisor](#) (November 2012 - May 2013)
- [Financial Advisor](#) (November 2012 - August 2014)
- [Brotherhood Development Director](#) (January 2011 - April 2011)
- [Philanthropy Director](#) (January 2009 - December 2010)
- [Treasurer](#) (January 2008 - December 2009)

Study Abroad in Argentina

June 2010 - August 2010

- Attained an intermediate working knowledge of spoken and written Spanish.
- Gained extensive practice in intercultural interactions.

MPowered Entrepreneurship

September 2009 - December 2009

- Member of team that planned Global Entrepreneurship week.
- Recruited entrants for 1000 Pitches contest.
- Promoted the philosophy of entrepreneurship throughout campus.

Youth Group of First United Methodist

September 2001 - June 2007

- Leader within a high school team that raised \$50,000 to build a church in Bulgaria.
- Part of team that won Michigan Peace Prize (2007) for filming a documentary on religious diversity.
- Participated in multiple service mission trips, including three international locations.

Boy Scouts of America*September 2000 - June 2007*

- Completed an Eagle Scout Service Project.
- Held various leadership positions, including Senior Patrol Leader.
- Participated in outdoor adventure activities with the Venture Patrol.
- Attended the 2001 National Scout Jamboree.
- Completed 25 skills-based merit badges.