Brian MacKie-Mason <bmackiemason@anl.gov>

http://brianmackiemason.com

EDUCATION

PhD Electrical Engineering *2018*
University of New Mexico

- **Dissertation Title**: Novel Algorithms for Ultra Scale Electromagnetic Problems in the Supercomputing Era.
- **Advisor**: Professor Zhen Peng, Department of Electrical & Computer Engineering, University of New Mexico

MS Nuclear Engineering *2013*
University of Wisconsin-Madison

BSE 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.
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.
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.

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.
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: C++, MATLAB, Bash shell, Python, C, Fortran
- Software Packages: ViSiT, CUBIT, KDevelop, SolidWorks (CAD), Improved Concurrent Electromagnetic Particle-in-Cell (ICEPIC), Intel VTUNE Amplifier
- 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

RESEARCH EXPERIENCE

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

- Optimize code for Intel KNL architecture. 30% speed-up acheived.
- 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.

Research Assistant *Fall 2013 - Spring 2018*
Department of Electrical 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 automatically partition mesh files for GA-IE-DDM utilizing a k-way graph partitioning code and creating a global-to-local mapping scheme.
- 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 M antennas are mounted on very large PEC platforms.

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

- Studied the effects of laser-induced field emission (2013).
- Designed diagnostics to improve the study of field emission (2012).
- Designed validation and verification test suite for ICEPIC (2011).

University of Michigan, Ann Arbor *May 2009 - August 2009*
Prof. Gary Was
Lab Assistant, Nuclear Materials

- 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.

University of Michigan, Ann Arbor *March 2008 - May 2009*
Prof. Yan Chen
Undergraduate Research Assistant, School of Information

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

University of Michigan, Ann Arbor *March 2008 - May 2009*
Prof. Yan Chen
Lab Assistant, School of Information

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

University of Michigan, Ann Arbor *May 2008 - July 2008*
Prof. Yan Chen
REU Student, School of Information

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

University of Michigan, Ann Arbor *May 2007 - August 2007*
Prof. Penner-Hahn
Lab Assistant, Department of Chemistry

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

Pioneer High School, Ann Arbor *September 2006 - January 2007*
Ms. Hochrein
Teaching Assistant, Mathematics Department

- Graded extra credit assignments.
- Taught a few lessons.
- Answered student questions.

University of Michigan, Ann Arbor *June 2006 - July 2006*
Prof. Sherman
Lab Assistant, Department of Biology

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

TEACHING EXPERIENCE

University of New Mexico *August 2014 - December 2014*
Department of Electrical & Computer Engineering
Albuquerque, NM
Graduate Teaching Assistant

- 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.

University of Wisconsin-Madison *January 2012 - May 2013*
Department of Engineering Physics
Madison, WI
Graduate Teaching Assistant, EMA 201: Statics

- 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.

Pioneer High School, Ann Arbor *September 2006 - January 2007*
Ms. Hochrein
Teaching Assistant, Mathematics Department

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

Math Tutor *January 2006 - May 2006*

- Provdided 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 - Present*

SIAM *2016 - Present*

APS *2018 - Present*

CLEARANCES

DoD 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 - Present*

- 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 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

ECE Graduate Student Association *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 - Present).
- 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*

- Co-leader of 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.