

# Brian MacKie-Mason <[bmackiemason@anl.gov](mailto:bmackiemason@anl.gov)>

<http://www.brianmackiemason.com>

## EDUCATION

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- 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

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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](https://doi.org/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](https://doi.org/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](https://doi.org/10.2528/PIER15113001).

## CONFERENCE PUBLICATIONS

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1. Jon Kelley, Kurt Norris, **Brian MacKie-Mason**, Brody Barton, David Chamulak, Scott Schaefer, Mark Martin, Kendall Crouch, Clifton Courtney, Ali Yilmaz, "Reproducible Measurements of "Fan Blades in a Pipe" CEM Benchmark", *45th Annual Meeting and Symposium of the Antenna Measurement Techniques Association*, Seattle, WA, October 8–18, 2023. (accepted)
2. **B. MacKie-Mason**, J. T. Kelley, K. A. Norris, S. Schaefer, M. Martin, S. Cox, C. C. Courtney, D. A. Chamulak, A. E. Yilmaz, "On the Sensitivity of RCS to Manufacturing Defects in as-Built Camera Boxes with Voids", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, Portland, OR, July 23–28, 2023.
3. J. T. Kelly, **B. MacKie-Mason**, K. A. Norris, B. Barton, D. A. Chamulak, S. Schaefer, M. Martin, S. Cox, C. C. Courtney, A. E. Yilmaz, "Using Camera Boxes to Build Reproducible CEM Benchmarks with Complex Ducts", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, Portland, OR, July 23–28, 2023.
4. A. Yilmaz, **B. MacKie-Mason**, S. Cox, C. Courtney and G. Burchuk, "On the Sensitivity of RCS to the Wall Conductivity of Highly-Conductive Structures with Voids", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, Denver, CO, July 10–15, 2022. doi:[10.1109/AP-S/USNC-URSI47032.2022.9887308](https://doi.org/10.1109/AP-S/USNC-URSI47032.2022.9887308).
5. A. Yilmaz, E. Smith, S. Cox, **B. MacKie-Mason**, C. Courtney and G. Burchuk, "Camera Boxes: A Set of Complex Scattering Problems to Test EM Simulations and Measurements", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, Denver, CO, July 10–15, 2022. doi:[10.1109/AP-S/USNC-URSI47032.2022.9887014](https://doi.org/10.1109/AP-S/USNC-URSI47032.2022.9887014).

6. A. Maicke, J. Kelley, **B. MacKie-Mason**, C. Courtney, S. Cox, D. Chamulak, G. Burchuk and A. Yilmaz, "A Benchmark Airplane Model with Ducts", *IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, Denver, CO, July 10–15, 2022. doi:[10.1109/AP-S/USNC-URSI47032.2022.9887354](https://doi.org/10.1109/AP-S/USNC-URSI47032.2022.9887354).
7. 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>.
8. **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).
9. 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).
10. **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

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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.
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.
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

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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

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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

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- 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 Solid-Works (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)
- $\mu$ Architectures: Intel [KNL](#), Intel’s next generation

## PROFESSIONAL EXPERIENCE

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**Staff Research Scientist, Computational Electromagnetics**  
**Senior Research Scientist, Computational Electromagnetics**  
**Lockheed Martin**

*January 2023 - Present*  
*April 2020 - December 2022*

**Kendall Crouch**

- Scientific Software Developer for 3D Method of Moments RCS Prediction Code
- PI for Domain Decomposition Methods
- TS Clearance

**Postdoctoral Appointee, Computational Plasma Physics**

*March 2018 - March 2020*

**Leadership Computing Facility**

**Argonne National Laboratory**

**Timothy J. Williams**

- Optimize code for [Intel KNL architecture](#). 30% speed-up achieved 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, Computational Electromagnetics**

*Fall 2013 - Spring 2018*

**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. Tang, Lockwood & 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**

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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**

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- 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**

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### **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 Use Committee](#) (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)