

# 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](#)

## PUBLICATIONS

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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 & OTHER PRESENTATIONS

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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 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**, 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>
5. **B. MacKie-Mason**, "What do I do?", *Argonne Computing Coffee & Code*, Argonne, IL, U.S.A., September 12, 2018. <https://goo.gl/AtWQSD>
6. **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)

7. **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>
8. **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>
9. **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/fgmvgvk>
10. **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>
11. 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)
12. **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)
13. 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/dkiyyX>
14. **B. MacKie-Mason**, W. Tang, "Modeling of laser-induced field emission", *Air Force Research Lab Annual Scholar Presentation*, Albuquerque, NM, July 2013.
15. **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.
16. **B. MacKie-Mason**, A. Greenwood, N. Lockwood, "Automated Testing of ICEPIC", *Air Force Research Lab Annual Scholar Presentation*, Albuquerque, NM, July 2011.

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## 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: [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

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## PROFESSIONAL EXPERIENCE

Postdoctoral Appointee

*March 2018 - Present*

[Leadership Computing Facility](#), [Argonne National Laboratory](#)

- 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.

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.

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## **PROFESSIONAL SERVICE**

Margaret Butler Review Committee

*March 2019*

Reviewer for *International Journal of Antennas and Propagation*

*2018*

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## **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 Graduate Student Association [Student Paper Competition](#) – Journal Paper Section, 3rd prize, 2016.
- [Eagle Scout](#), February 2007

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## **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)