Luis Gomez

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(954)8165011, luisgo@umich.edu

Education

Ph.D. Electrical Engineering, University of Michigan, Ann Arbor, MI — May 2015
Dissertation: "*Computational Electromagnetics Methods for Transcranial Magnetic Stimulation.*"
Advisor: Eric Michielssen

M.S. Electrical Engineering, University of Michigan, Ann Arbor, MI — May 2014

M.S. Applied Mathematics, University of Michigan, Ann Arbor, MI — Dec 2013

B.S. Electrical Engineering, University of Florida, Gainesville, FL — Aug 2008
Honors Thesis: "*A MIMO-Inspired High-Resolution, Sparse, Dynamically-Steered Phased Array Receive Antenna*."
Advisor: Henry Zmuda

B.S. Mathematics, University of Florida, Gainesville, FL — Aug 2008

Awards/Fellowships

EECS Outstanding Graduate Student Instructor Award (*awarded to one GSI each term*) — May 2014

NSF Graduate Research Fellowship (*3 years of funding*) — Nov 2009

Rackham Merit Fellowship (*2 years of funding*) — Aug 2008

Research Experience

Post-doctoral Fellow, Duke University Medical School, Ann Arbor, MI — Aug 2016-Present

- Project 1: Development of optimization methods for design of Transcranial magnetic stimulation (TMS) coils achieving optimal depth, focality and energy tradeoffs
- Project 2: Development of novel computational electromagnetics solvers for high-fidelity electromagnetic modelling of fields generated during TMS

Post-doctoral Fellow, University of Michigan: Radiation Laboratory, Ann Arbor, MI — Jan 2015-July 2016

- Project 1: Development of deep learning methodologies for use in inverse scattering algorithms
- Project 2: Implementation of a general purpose fast-multipole fast-fourier transform accelerated internally combined volume surface integral equation solver for broadband electromagnetic analysis of high-permittivity and negative permittivity objects
- Project 3: Focal single-source multicoil TMS coil design validation

Graduate Research Assistant, University of Michigan: Radiation Laboratory, Ann Arbor, MI — Aug 2008-Dec 2014

- Project 1: Development of novel eddy-current finite-difference, integral equation techniques for the analysis of electric fields during transcranial magnetic stimulation (TMS)
- Project 2: Development of optimization methodologies design of TMS coils
- Project 3: Development of uncertainty quantification methodologies for TMS
- Project 4: Development of a fast-finite difference solver for use in real-time analysis of fields generated during TMS

Publications

Journal Papers

1. **L. J. Gomez**, S. Goetz, and A. V. Peterchev, "Design of Transcranial Magnetic Stimulation Coils with Optimal Trade-off between Depth, Focality, and Energy," *Journal of neural engineering*, 2018.
2. B. Wang, Z. Deng, J. Smith, J. Tharayil, C. Gurrey, **L. J. Gomez**, A. Peterchev, "Redesigning existing transcranial magnetic stimulation coils to reduce energy: application to low field magnetic stimulation," *Journal of neural engineering*, 2018.
3. A. C. Yucel, **L. J. Gomez**, and E. Michielssen, "Internally Combined Volume-Surface Integral Equation for EM Analysis of Inhomogeneous Negative Permittivity Plasma Scatterers," *IEEE Transactions on Antennas and Propagation*, vol. 66, no. 4, pp. 1903-1913, 2018.

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4. **L. J. Gomez**, A. C. Yücel, and E. Michielssen, "The ICVSIE: A General Purpose Integral Equation Method for Bio-Electromagnetic Analysis," *IEEE Transactions on Biomedical Engineering*, vol. 65, no. 3, pp. 565-574, 2018.
5. A. C. Yucel, **L. J. Gomez**, and E. Micielssen, "Compression of Translation Operator Tensors in FMM-FFT-Accelerated SIE Solvers via Tucker Decomposition," *IEEE Antennas and Wireless Propagation Letters*, vol. 16, pp. 2667-2670, 2017.
6. **L. J. Gomez**, A. C. Yucel, and E. Michielssen, "Internally Combined Volume-Surface Integral Equation for a 3-D Electromagnetic Scattering Analysis of High-Contrast Media," *IEEE Antennas and Wireless Propagation Letters*, vol. 16, pp. 1691-1694, 2017.
7. **L. J. Gomez**, A. C. Yücel, L. Hernandez-Garcia, S. F. Taylor, and E. Michielssen, "Uncertainty quantification in transcranial magnetic stimulation via high-dimensional model representation," *IEEE Transactions on Biomedical Engineering*, vol. 62, no. 1, pp. 361-372, 2015.
8. **L. J. Gomez**, A. C. Yücel, and E. Michielssen, "Low-frequency stable internally combined volume-surface integral equation for high-contrast scatterers," *IEEE Antennas and Wireless Propagation Letters*, vol. 14, pp. 1423-1426, 2015.
9. **L. J. Gomez**, A. C. Yücel, and E. Michielssen, "Volume-surface combined field integral equation for plasma scatterers," *IEEE Antennas and Wireless Propagation Letters*, vol. 14, pp. 1064-1067, 2015.
10. **L. J. Gomez**, F. Cajko, L. Hernandez-Garcia, A. Grbic, and E. Michielssen, "Numerical analysis and design of single-source multicoil TMS for deep and focused brain stimulation," *IEEE transactions on biomedical engineering*, vol. 60, no. 10, pp. 2771-2782, 2013.
11. L. Hernandez-Garcia, T. Hall, **L. J. Gomez**, and E. Michielssen, "A numerically optimized active shield for improved transcranial magnetic stimulation targeting," *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation*, vol. 3, no. 4, pp. 218-225, 2010.

Conference Presentations

1. **L. J. Gomez**, W. Sheng, A. Yücel, E. Michielssen, "Fast Statistical Characterization of Rough Surface Scattering via Tensor Train Decompositions," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2016
2. **L. J. Gomez**, N. Dalal, A. Yücel, R. Villegas, L. Honglak, E. Michielssen, "Deep Learning Augmented Inverse Scattering Algorithm," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2016
3. A. Yücel, **L. J. Gomez**, E. Michielssen, "An Internally Combined Volume-Surface Integral Equation for 3D Plasma Scatterers," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2015
4. A. Yücel, **L. J. Gomez**, E. Michielssen, "Tucker Decomposition for Compressing Translation Operator Tensors in FMM-FFT Accelerated SIE Solvers," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2015
5. **L. J. Gomez**, A. Yücel, E. Michielssen, " Low-Frequency Stable Internally Combined Volume-Surface Integral Equation for 3D High-Contrast Scatterers," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2015
6. A. Yücel, **L. J. Gomez**, E. Michielssen, "An Internally Combined Volume-Surface Integral Equation for 3D Plasma Scatterers," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2015
7. A. Yücel, **L. J. Gomez**, E. Michielssen, "Tucker Decomposition for Compressing Translation Operator Tensors in FMM-FFT Accelerated SIE Solvers," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2015
8. A. Yücel, **L. J. Gomez**, Y. Liu, H. Bagci, E. Michielssen, " A FMM-FFT Accelerated Hybrid Volume Surface Integral Equation Solver for Electromagnetic Analysis of Re-Entry Space Vehicles," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2014
9. **L. J. Gomez**, A. Yücel, E. Michielssen, " Sensitivity of TMS-Induced Electric Fields to the Uncertainty in Coil Placement and Brain Anatomy," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2014

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10. **L. J. Gomez**, A. Yücel, E. Michielssen, " A Well-Conditioned Volume-Surface Combined Field Integral Equation (VSCFIE) for Inhomogeneous Scatterers with Negative Permittivities," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2014
11. **L. J. Gomez**, A. Yücel, L. Hernandez, E. Michielssen, " Uncertainty Quantification in Transcranial Magnetic Stimulation," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2013
12. **L. J. Gomez**, E. Michielssen, " A Well-Conditioned Volume-Surface Field Integral Equation (VSCFIE) for Inhomogeneous Cylindrical Scatterers with High-Electrical Contrasts," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2013
13. **L. J. Gomez**, L. Hernandez, A. Grbic, E. Michielssen, " Single-Source Multi-Coil Transcranial Magnetic Stimulators for Deep and Focused Stimulation of the Human Brain," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2013
14. F. Cajko, E. Michielssen, **L. J. Gomez,** P. G. Martinsson, L. Hernandez, "A fast direct solver for TMS analysis and design in 3D," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2011
15. **L. J. Gomez**, L. Hernandez, A. Grbic, E. Michielssen, "Focused multi-coil transcranial magnetic stimulation," Antennas and Propagation Society International Symposium (APSURSI), July 2011
16. F. Cajko, E. Michielssen, **L. J. Gomez,** P. G. Martinsson, L. Hernandez, " A Fast Direct Solver for Transcranial Magnetic Stimulation Analysis," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2010
17. **L. J. Gomez**, L. Hernandez, A. Grbic, E. Michielssen, "A simulation of focal brain stimulation using metamaterial lenses," *Antennas and Propagation Society International Symposium (APSURSI)*, July 2010

Teaching Experience

Graduate Student Instructor, University of Michigan, Ann Arbor, MI — Jan-May 2014

- Class Title: Electrical Circuits, Systems, and Applications (EECS 314)
- Collaborated on class specifics and exam development, met with students for one on one tutoring, was responsible for grading and organization of four weekly lab sections each with ~20 students

Tutor, University of Florida: Broward Tutoring Center, Gainesville, FL — Sept-Dec 2007

- Held private, as well as, 'walk in' tutoring sessions on various subjects including: Circuits 2, Signals and Systems, Linear Algebra, Calculus 3, Advanced Calculus, Numbers and Polynomials, Digital Logic, Physics 1 and 2

Internship Experience

Product Cost Take Out Intern, GE Consumer and Industrial, Louisville, KY — Jan-May 2008

- Worked in finding creative ways to remove cost from range electronics
- Analyzed several temperature sensors and found a more cost efficient solution for temperature measurements in convection ovens.

Undergraduate Research Intern, Northwestern University: Center for Photonic Communication and Computing, Evanston, IL — June-Aug 2007

- Developed a framework for automatically sending and collecting data from an AOM pulse shaping setup. Then, used the framework to collect data showing linear and quadratic phase modulation of a 2.6 picoseconds pulse.

Undergraduate Research Intern, Massachusetts Institute of Technology: Computer Science and Artificial Intelligence Lab (CSAIL), Cambridge, MA — June-Aug 2006

- Developed automated digital filters to remove noise from an audio signal using Fourier and Short-time Fourier techniques; developed test methods to compare various filter efficiencies. Studied Speech Recognition systems and different pattern recognition algorithms

Service

Society of Hispanic Professional Engineers (SHPE) University of Michigan

- SHPE-Grad Professional Chair — 2013-2014

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- SHPE-Grad Professional Chair 2012-2013
- SHPE Alumni Chair 2012-2013
- SHPE-Grad Graduate Programs Liaison 2012-2013
- SHPE Recruitment and Retention Chair 2011-2012
- SHPE-Grad Social Chair 2011-2012