

# Yang Liu

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## RESEARCH INTERESTS

**Computational Electromagnetics:** fast time-domain and frequency-domain integral equation methods, butterfly-based direct solver, plane-wave-time-domain algorithm for solving large-scale transient scattering problems, multi-physics and multi-scale modeling.  
**Scientific Computing:** high performance computing, randomized matrix algorithms, compressive sensing, uncertainty quantification, data-driven simulation techniques.

## EDUCATION

### University of Michigan

- Ph.D., Electrical Engineering (advisor: [Eric Michielssen](#)), May 2015
- M.S., Mathematics, Nov. 2014
- M.S., Electrical Engineering, May 2013

### Shanghai Jiao Tong University

- B.S., Electrical Engineering, June 2010

## RESEARCH EXPERIENCE

- **Research Fellow**, University of Michigan **June 2015 to Present**  
Originate butterfly-based low-complexity direct frequency-domain integral equation solvers for high-frequency electromagnetic scattering problems.
- **Research Assistant**, University of Michigan **Sept. 2010 to May 2015**  
Create provably scalable and wavelet-enhanced time-domain integral equation solvers for large-scale transient electromagnetic scattering problems.
- **Undergraduate Researcher**, Shanghai Jiao Tong University **Apr. 2009 to June 2010**  
Develop a two-dimensional ADE-FDTD algorithm for numerical modeling the ELF wave propagation in ionosphere.  
Develop a robust compressive sensing algorithm for joint signal recovery in cognitive radio networks.

## TEACHING EXPERIENCE

- **Teaching Assistant**, Shanghai Jiao Tong University **Mar. 2009 to June 2009**  
Instruct student in FPGA programming for digital circuit designs.

## HONORS AND AWARDS

- First Place in Student Paper Competition, 12th International Workshop on Finite Elements for Microwave Engineering, 2014
- Second Place in Student Paper Competition, 28th Annual Review of Progress in Applied Computational Electromagnetics, 2012
- Rackham Travel Grant, University of Michigan, 2012 to 2014
- Outstanding Graduate Award, Shanghai Jiao Tong University, 2010
- Third Prize in National Electronic Contest, China, 2009

## PROFESSIONAL ACTIVITIES AND SERVICES

- **Reviewer** for “International Journal of Numerical Modelling: Electronic Networks, Devices and Fields”, “Journal of Applied Computational Electromagnetics Society”, and “Journal of Microwaves, Optoelectronics and Electromagnetic Applications”.
- **Session Chair** for “Time-Domain Numerical Methods,” IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting, 2012.

- **Session Judge** for the 10th Annual Engineering Graduate Symposium, University of Michigan, 2015.
- **Steering Committee** for “Celebrating Maxwell’s Equations: 150 years” workshop, 2015.
- **Secretary** for Technical Activities Committee, IEEE Southeastern Michigan Section.

REFEREED  
JOURNAL  
PUBLICATIONS

- [1] **Y. Liu**, A. Al-Jarro, H. Bagci, and E. Michielssen, “Parallel PWTD-accelerated explicit solution of the time domain electric field volume integral equation,” *IEEE Trans. Antennas Propag.*, 2016. doi:[10.1109/TAP.2016.2546964](https://doi.org/10.1109/TAP.2016.2546964)
- [2] **Y. Liu**, A. C. Yucel, H. Bagci, and E. Michielssen, “A scalable parallel PWTD-accelerated surface integral equation solver for analysis of transient scattering from large-scale objects,” *IEEE Trans. Antennas Propag.*, 2016. doi:[10.1109/TAP.2015.2508483](https://doi.org/10.1109/TAP.2015.2508483)
- [3] **Y. Liu**, A. C. Yucel, V. Lomakin, and E. Michielssen, “Graphics processing unit implementation of multilevel plane-wave time-domain algorithm,” *IEEE Antennas Wireless Propag. Lett.*, vol. 1, pp. 1-1, 2014. doi:[10.1109/LAWP.2014.2350967](https://doi.org/10.1109/LAWP.2014.2350967)
- [4] A. C. Yucel, **Y. Liu**, H. Bagci, and E. Michielssen, “Statistical characterization of electromagnetic wave propagation in mine environments,” *IEEE Antennas Wireless Propag. Lett.*, vol. 12, pp. 1602-1605, 2013. doi:[10.1109/LAWP.2013.2293288](https://doi.org/10.1109/LAWP.2013.2293288)
- [5] **Y. Liu**, A. C. Yucel, H. Bagci, A. C. Gilbert, and E. Michielssen, “Wavelet-enhanced plane-wave time-domain algorithm for analysis of transient scattering from electrically large conducting objects,” *IEEE Trans. Antennas Propag.*, (submitted).
- [6] H. Guo, **Y. Liu**, J. Hu, and E. Michielssen, “A MLMDA-based direct integral equation solver for analyzing scattering from electrically large PEC objects,” *IEEE Trans. Antennas Propag.*, (submitted).

IN  
PREPARATION

- [7] **Y. Liu**, H. Guo, and E. Michielssen, “A randomized butterfly-based fast direct solver for analyzing scattering from two-dimensional objects,” *IEEE Antennas Wireless Propag. Lett.*
- [8] **Y. Liu**, H. Guo, and E. Michielssen, “A randomized algorithm for butterfly factorization,” *SIAM J. Sci. Comput.*

CONFERENCE  
PUBLICATIONS

- [1] **Y. Liu**, H. Guo, and E. Michielssen, “A new MLMDA-based direct integral equation solver for electrically perfect conducting objects,” in *Proc. IEEE Int. Symp. AP-S/URSI*, 2016.
- [2] **Y. Liu**, H. Guo, and E. Michielssen, “A new butterfly reconstruction method for MLMDA-based direct integral equation solvers,” in *Proc. IEEE Int. Symp. AP-S/URSI*, 2016.
- [3] **Y. Liu**, A. C. Yucel, A. C. Gilbert, H. Bagci, and E. Michielssen, “A wavelet-based PWTD algorithm-accelerated time domain surface integral equation solver,” in *Proc. IEEE Int. Symp. AP-S/URSI*, 2015.
- [4] A. C. Yucel, **Y. Liu**, H. Bagci, and E. Michielssen, “An FMM-FFT accelerated integral equation solver for characterizing electromagnetic wave propagation in mine tunnels and galleries loaded with conductors,” in *Proc. IEEE Int. Symp. AP-S/URSI*, 2014.
- [5] **Y. Liu**, A. C. Yucel, H. Bagci, and E. Michielssen, “A parallel wavelet-enhanced PWTD algorithm for analyzing transient scattering from electrically very large PEC targets,” in *Proc. IEEE Int. Symp. AP-S/URSI*, 2014.
- [6] **Y. Liu**, A. C. Yucel, H. Bagci, and E. Michielssen, “Parallel time domain solvers for electrically large transient scattering problems,” **invited talk**, in *Proc. EUCAP*, 2014.

- [7] A. C. Yucel, L. Gomez, **Y. Liu**, H. Bagci, and E. Michielssen, "A FMM-FFT accelerated hybrid volume surface integral equation solver for electromagnetic analysis of re-entry space vehicles," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2014.
- [8] **Y. Liu**, A. C. Yucel, H. Bagci, and E. Michielssen, "Parallel multilevel PWTD-enhanced time domain integral equation solvers," in *Proc. SC13*, 2013.
- [9] H. Guo, **Y. Liu**, H. Jun, and E. Michielssen, "A parallel MLMDA-based direct integral equation solver," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2013.
- [10] A. C. Yucel, **Y. Liu**, H. Bagci, and E. Michielssen, "A fast-multipole domain decomposition integral equation solver for characterizing electromagnetic wave propagation in mine environments," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2013.
- [11] **Y. Liu**, H. Bagci, and E. Michielssen, "Progress in parallel implementation of the multilevel plane wave time domain algorithm," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2013.
- [12] **Y. Liu**, H. Bagci, and E. Michielssen, "Solving very large scattering problems using a parallel PWTD-enhanced surface integral equation solver," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2013.
- [13] **Y. Liu**, A. Al-Jarro, H. Bagci, and E. Michielssen, "Parallel, explicit, and PWTD-enhanced time domain volume integral equation solver," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2013.
- [14] **Y. Liu**, V. Lomakin, and E. Michielssen, "Graphics processing unit-accelerated implementation of the plane wave time domain algorithm," *28th Ann. Rev. Prog. Appl. Computat. Electromagn.*, 2012.
- [15] **Y. Liu**, A. C. Yucel, V. Lomakin, and E. Michielssen, "A scalable parallel implementation of the plane wave time domain algorithm on graphics processing unit-augmented clusters," in *Proc. IEEE Int. Symp. AP-S/URSI*, 2012.
- [16] J. Liang, **Y. Liu**, W. Zhang, Y. Xu, X. Gan, and X. Wang, "Joint compressive sensing in wideband cognitive networks," in *Proc. IEEE WCNC*, 2010.

#### APPLICABLE SKILLS

- Computer Programming: Fortran, C, C++, ASM, Verilog, VHDL, Python
- Numerical Analysis: Matlab, R, Mathematica
- Electromagnetic and other relevant Softwares: CST, ADS, HFSS, FEKO, COMSOL, ProE, Solidworks