
RESEARCH INTERESTS

- General
 - Theoretical and computational electromagnetic wave propagation and scattering
 - Bridging the gap between theoretical methods and their practical implementation
- Recent
 - Wave propagation in random and complex media, direct and inverse scattering, remote sensing, polarimetric imaging, compressed sensing, antenna characterization, near-to-far-field theory, T -matrix method, singular and nonsingular integral equation methods, fast multipole method

EDUCATION

- Dec. 13, 2013 **PhD in Applied Physics**, *Colorado School of Mines*, Golden, CO
Dissertation *Modern electromagnetic scattering*, Advisor: Prof. John A. Scales, GPA: 4.0/4.0
- Dec. 16, 2005 **MS in Applied Physics**, *Colorado School of Mines*, Golden, CO
Thesis *A new integral equation method for direct electromagnetic scattering in homogeneous media and its numerical confirmation*, Advisor: Prof. John A. DeSanto, GPA: 4.0/4.0
- Dec. 12, 2003 **BS in Engineering Physics**, *Colorado School of Mines*, Golden, CO
Graduated with High Scholastic Honors
- Dec. 12, 2003 **BS in Mathematical and Computer Sciences**, *Colorado School of Mines*, Golden, CO
Graduated with High Scholastic Honors

EXPERIENCE

PROFESSIONAL

- 06/2019–current **Physicist (ZP-1310-04)**, *National Institute of Standards and Technology*, Boulder, CO
 - Produced 4 refereed publications and 5 presentations
 - Advised 2 Ph.D. students (Applied Mathematics and Statistics, Electrical Engineering)
 - Created sparse near-to-far-field transformation method with guaranteed compressed sensing recovery
 - Developed new gain and polarization algorithms for NIST's Antenna Calibration Service
 - Created a new nonsingular surface integral equation method for electromagnetic scattering
- 09/2016–06/2019 **Physicist (ZP-1310-03)**, *National Institute of Standards and Technology*, Boulder, CO
 - Produced 9 refereed publications, 1 U.S. patent application, 5 presentations (2 invited), and 1 poster
 - Developed near-to-far-field transformation method on an arbitrary set of measurement points
 - Created a new tensorial surface integral equation formulation for electromagnetic scattering
 - Developed fast superposition T -matrix method based on volume integral equations
 - Updated and maintained legacy Fortran near-field scanning software
- 11/2015–09/2016 **Physical Scientist (DB-1301-03)**, *Army Research Laboratory*, Adelphi, MD
 - Produced 5 refereed publications and 1 invited international presentation
 - Research highlighted in *Optics & Photonics News* magazine and featured on its cover
 - Developed theory on scattering properties of charged particles containing optical resonances
- 09/2013–11/2015 **ORAU Postdoctoral Research Fellow**, *Army Research Laboratory*, Adelphi, MD
 - Produced 5 refereed publications, 1 U.S. patent application, and 8 presentations (2 invited)
 - Featured on the cover of *Applied Optics* journal
 - Had 2 manuscripts re-published in the *Virtual Journal for Biomedical Optics*
 - Developed 3D polarimetric imaging method for facial recognition

INDUSTRY

- 01/2006–01/2007 **Research Scientist II**, *Numerica Corporation*, Fort Collins, CO
 - Developed and implemented target-tracking algorithms in support of the Missile Defense Agency

ACADEMIC

- 01/2009–08/2013 **Research Assistant**, *Department of Physics*, Colorado School of Mines
- Analyzed complex experimental wave propagation data and interpreted the results
 - Produced novel computational methods to describe wave propagation in complex media
 - Co-taught 2 graduate and 2 undergraduate courses on electromagnetic waves and math methods
- 08/2008–12/2008 **Adjunct Instructor**, *Dept. of Applied Mathematics & Statistics*, Colorado School of Mines
- Taught 2 sections of Calculus III. Text: J. Stewart, *Calculus* 3rd ed., chapters 9–13 (2006)

REFEREED PUBLICATIONS

JOURNAL ARTICLES

1. **A. J. Yuffa**, "Vectorizing Green's identities," *J. Phys. Commun.* **5**, 055001 (2021)
2. Q. Sun, E. Klaseboer, **A. J. Yuffa**, and D. Y. C. Chan, "Field-only surface integral equations: Scattering from a dielectric body," *J. Opt. Soc. Am. A* **37**, 284–293 (2020)
3. Q. Sun, E. Klaseboer, **A. J. Yuffa**, and D. Y. C. Chan, "Field-only surface integral equations: Scattering from a perfect electric conductor," *J. Opt. Soc. Am. A* **37**, 276–283 (2020)
4. J. Markkanen, **A. J. Yuffa**, and J. A. Gordon, "Numerical validation of a boundary element method with electric field and its normal derivative as the boundary unknowns," *Appl. Comput. Electromagn. Soc. J.* **34**, 220–223 (2019)
5. **A. J. Yuffa** and J. Markkanen, "A 3-D tensorial integral formulation of scattering containing intriguing relations," *IEEE Trans. Antennas Propag.* **66**, 5274–5281 (2018)
6. J. Markkanen and **A. J. Yuffa**, "Fast superposition T-matrix solution for clusters with arbitrarily-shaped constituent particles," *J. Quant. Spectrosc. Radiat. Transfer* **189**, 181–188 (2017)
7. **A. J. Yuffa**, V. Kaydash, V. Korokhin, Yu. Shkuratov, E. Zubko, and G. Videen, "Phase-ratio imaging as applied to desert sands for tracking human presence," *Appl. Opt.* **56**, B184–B190 (2017)
8. Y.-L. Pan, C. Wang, L. A. Beresnev, **A. J. Yuffa**, G. Videen, D. Ligon, and J. L. Santarpia, "Measurement of back-scattering patterns from single laser trapped aerosol particles in air," *Appl. Opt.* **56**, B1–B4 (2017)
9. N. J. Short, **A. J. Yuffa**, G. Videen, and S. Hu, "Effects of surface materials on polarimetric-thermal measurements: Applications to face recognition," *Appl. Opt.* **55**, 5226–5233 (2016)
10. **A. J. Yuffa**, Ya. Gutierrez, J. M. Sanz, R. Alcaraz de la Osa, J. M. Saiz, F. González, F. Moreno, and G. Videen, "Near- and far-field scattering resonances frequency shift in dielectric and PEC cylinders," *J. Opt. Soc. Am. A* **33**, 391–395 (2016)
11. M. Kocifaj, F. Kundracik, G. Videen, **A. J. Yuffa**, and J. Klačka, "Optical resonances in electrically charged particles and their relation to the Drude model," *J. Quant. Spectrosc. Radiat. Transfer* **178**, 224–229 (2016)
12. **A. J. Yuffa**, Ya. Gutierrez, J. M. Sanz, R. Alcaraz de la Osa, J. M. Saiz, F. González, F. Moreno, and G. Videen, "Frequency shift between near and far-field scattering resonances in dielectric particles," *J. Opt. Soc. Am. A* **32**, 1638–1642 (2015)
13. G. Videen, E. Zubko, W. Sun, Yu. Shkuratov, and **A. J. Yuffa**, "Mixing rules and morphology dependence of the scatterer," *J. Quant. Spectrosc. Radiat. Transfer* **150**, 68–75 (2015)
14. **A. J. Yuffa**, K. P. Gurton, and G. Videen, "Three-dimensional facial recognition using passive long-wavelength infrared polarimetric imaging," *Appl. Opt.* **53**, 8514–8521 (2014)

15. K. P. Gurton, **A. J. Yuffa**, and G. W. Videen, "Enhanced facial recognition for thermal imagery using polarimetric imaging," *Opt. Lett.* **39**, 3857–3859 (2014)
16. **A. J. Yuffa**, P. A. Martin, and J. A. Scales, "Scattering from a large cylinder with an eccentrically embedded core: An orders-of-scattering approximation," *J. Quant. Spectrosc. Radiat. Transfer* **133**, 520–525 (2014)
17. **A. J. Yuffa** and J. A. Scales, "Measuring the void: Theoretical study of scattering by a cylindrical annulus," *J. Quant. Spectrosc. Radiat. Transfer* **131**, 188–193 (2013)
18. **A. J. Yuffa** and J. A. Scales, "Linear response laws and causality in electrodynamics," *Eur. J. Phys.* **33**, 1635–1650 (2012)
19. **A. J. Yuffa** and J. A. Scales, "Object-oriented electrodynamic S-matrix code with modern applications," *J. Comput. Phys.* **231**, 4823–4835 (2012)
20. J. A. DeSanto and **A. J. Yuffa**, "A new integral equation method for direct electromagnetic scattering in homogeneous media and its numerical confirmation," *Waves in Random and Complex Media* **16**, 397–408 (2006)

CONFERENCE PROCEEDINGS

21. **A. J. Yuffa**, "On Wacker's essential equation in the extrapolation measurement technique," in *Proc. Antenna Meas. Techn. Assoc.* (San Diego, CA, 2020)
22. Q. Sun, E. Klaseboer, **A. J. Yuffa**, and D. Y. C. Chan, "A simple and robust surface integral method to model light and matter interactions," in *Proc. SPIE*, Vol. 11201 (Melbourne, Australia, 2019) p. 112010C, INVITED
23. **A. J. Yuffa**, J. Markkanen, Q. Sun, E. Klaseboer, and D. Y. C. Chan, "A new perspective on an old problem: Scattering by a perfect electric conductor," in *Proc. Int. Appl. Comput. Electromagn. Soc. Symp.* (Miami, FL, 2019)
24. **A. J. Yuffa**, B. F. Jamroz, J. D. Rezac, and D. F. Williams, "Systematic study: Channel sounding via modal expansion," in *Proc. Antenna Meas. Techn. Assoc.*, Vol. 40 (Williamsburg, VA, 2018)
25. D. R. Novotny, **A. J. Yuffa**, R. C. Wittmann, M. H. Francis, and J. A. Gordon, "Some advantages of using bi-directional S-parameters in near-field measurements," in *Proc. Antenna Meas. Techn. Assoc.*, Vol. 40 (Williamsburg, VA, 2018)
26. J. Markkanen, **A. J. Yuffa**, and J. A. Gordon, "Numerical validation of a boundary element method with \mathbf{E} and $\partial\mathbf{E}/\partial N$ as the boundary unknowns," in *Proc. Int. Appl. Comput. Electromagn. Soc. Symp.* (Denver, CO, 2018)
27. A. E. Curtin, D. R. Novotny, **A. J. Yuffa**, and S. Leitner, "Channel de-embedding and measurement system characterization for MIMO at 75 GHz," in *Proc. Antenna Meas. Techn. Assoc.*, Vol. 39 (Atlanta, GA, 2017)
28. K. P. Gurton, **A. J. Yuffa**, and G. Videen, "LWIR polarimetry for enhanced facial recognition in thermal imagery," in *Proc. SPIE*, Vol. 9099, edited by D. B. Chenault and D. H. Goldstein (Baltimore, MD, 2014) p. 90990G1
29. **A. J. Yuffa** and J. A. Scales, "Need for new property measurements methods to assess irradiation damage," in *Nuclear Materials Compatibility Data-Mining, Assessment, Storage, and Identification of Research Needs*, edited by N. Gubel, D. Olson, B. Mishra, J. Jackson, A. Lasseigne, J. Morrell, and K. Johnson (Y-12 National Security Complex, Oak Ridge, TN, 2012) pp. 55–65

PATENTS

1. S. Hu, N. J. Short, **A. J. Yuffa**, G. Videen, and K. P. Gurton, "3D polarimetric face recognition system," U.S. patent 10915737, February 9, 2021
2. G. Videen, K. P. Gurton, and **A. J. Yuffa**, "Method for modeling a three-dimensional topological surface of an object from long-wave-infrared radiation emitted from the object," U.S. patent 9609238, March 28, 2017

COMPUTER SKILLS

(SKILL LEVEL RATING SCHEME: *Basic, Intermediate, Advanced*)

- **Fortran and Python**
 - *Advanced* skill level
 - 15⁺ years of experience
 - Developed electromagnetic software
- **Mathematica**
 - *Advanced* skill level
 - 20⁺ years of experience
 - Taught specialized college courses
- **Linux**
 - *Advanced* skill level
 - 20⁺ years of experience
 - Beowulf cluster administrator
- **HPC**
 - *Intermediate* skill level
 - 2 years of experience on Cray XC40
 - Developed electromagnetic software
- **MATLAB**
 - *Intermediate* skill level
 - Designed 3D polarimetric imaging
 - Designed target-tracking algorithms
- **C/C++**
 - *Basic* skill level
 - 2 semesters of formal training
 - Interfaced with Fortran and Python

SYNERGISTIC ACTIVITIES

- Contributor ANSI-ASC-C63.25.3 Massive MIMO Test Distance Study
- Session Co-Chair USNC-URSI National Radio Science (January 2017)
- Proposal Reviewer U.S. Army Research Office, U.S. Army Small Business Innovation Research (SBIR), AMTA Student Travel Scholarship
- Journal Referee Applied Computational Electromagnetics Society Journal Applied Optics, Computer Physics Communications, IEEE Transactions on Antennas and Propagation, International Journal of Antennas and Propagation, Journal of Quantitative Spectroscopy and Radiative Transfer, Journal of Renewable and Sustainable Energy, Journal of Renewable and Sustainable Energy, Journal of the Optical Society of America A, Journal of the Optical Society of America B, Materials, Optics Express, Optics Letters, Physical and Engineering Sciences, Proceedings of the Royal Society A: Mathematical, Quarterly Journal of Mechanics and Applied Mathematics, Sensors, SIAM Journal on Applied Mathematics, Symmetry

PRESENTATIONS & POSTERS

- Talk **On Wacker's Essential Equation in the Extrapolation Measurement Technique**, *AMTA Annual Meeting and Symposium*, San Diego, California (October 2019)
- Talk **Spatial Sampling Patterns for Robust Field Reconstruction in 2-D**, *Progress in Electromagnetics Research Symposium*, Rome, Italy (June 2019)
- Talk **Continuity Condition of the Normal Derivative of the E-field Across an Arbitrary Interface and Its Application to Scattering**, *Progress in Electromagnetics Research Symposium*, Rome, Italy (June 2019)
- Talk **Theory and Computations for Next-Generation RF Measurement Platforms**, *National Institute of Standards and Technology*, Boulder, Colorado (April 2019)

- Talk **A New Perspective on an Old Problem: Scattering by a Perfect Electric Conductor**, *International ACES Symposium*, Miami, Florida (April 2019)
- Talk **Systematic Study: Channel Sounding via Modal Expansion**, *AMTA Annual Meeting and Symposium*, Williamsburg, Virginia (November 2018)
- Poster **An Electromagnetic Scattering Formulation with Surprising Consequences and Applications**, *AGU Fall Meeting*, New Orleans, Louisiana (December 2017)
- INVITED TALK **Application of Differential Geometry to Electromagnetic Wave Phenomena and the Surprising Consequences of the Normal Derivative**, *Department of Physics*, Kansas State University (December 2017)
- INVITED TALK **Completely Passive 3D Imaging**, *Army Research Laboratory Technology Showcase*, Silver Spring, Maryland (June 2017)
- Talk **Construction of 3D Images from Stokes Parameters**, *Computational STEM Seminar*, Colorado School of Mines (March 2017)
- Talk **Surface Integral Equation Formulation of Electromagnetic Scattering for Cloaking Applications**, *USNC-URSI National Radio Science Meeting*, Boulder, Colorado (January 2017)
- INVITED TALK **Extracting Near-Field Scattering Resonances from Far-Field Measurements**, *EMN Meeting on Light-Matter Interactions*, Singapore (May 2016)
- Talk **Red-Shift between Near and Far-Field Electric Intensity Peaks**, *Progress in Electromagnetics Research Symposium*, Prague, Czech Republic (July 2015)
- Talk **3D Polarimetric Imaging of Complicated Surfaces**, *Progress in Electromagnetics Research Symposium*, Prague, Czech Republic (July 2015)
- Talk **On Spectral Redshift Separating Near and Far-Field Intensity Resonances**, *Electromagnetic & Light Scattering XV*, Leipzig, Germany (June 2015)
- Talk **Near & Far-Field Resonances**, *Workshop on Light Scattering*, Bremen, Germany (March 2015)
- Talk **Retrieving 3D Facial Features from LWIR Polarimetric Images**, *22nd Annual ARL/USMA Technical Symposium*, Aberdeen Proving Ground, Maryland (October 2014)
- INVITED TALK **Electromagnetic Scattering by Multiple Particles**, *Naval Research Laboratory Meeting*, Washington, D.C. (October 2014)
- Talk **LWIR Polarimetry for Enhanced Facial Recognition in Thermal Imagery**, *SPIE Sensing Technology + Applications*, Baltimore, Maryland (May 2014)
- INVITED TALK **Consequences of Causality in Electrodynamics**, *Department of Physics & Astronomy*, Mississippi State University (April 2014)
- Poster **3D Face Reconstruction from IR Polarimetric Measurements**, *21st Annual ARL/USMA Technical Symposium*, Aberdeen Proving Ground, Maryland (April 2014)
- Poster **Scattering from a Large Eccentric Cylinder**, *Electromagnetic & Light Scattering XIV*, Lille, France (June 2013)
- Poster **Multiple Scattering: Enhanced Energy Density**, *SEMIwave Annual Review Meeting*, Indian Head, Maryland (October 2011)
- Talk **The Undead Fresnel**, *Physics Department Colloquium*, Colorado School of Mines (Dec. 2010)
- Talk **Wide Open Python**, *REMRSEC Graduate Seminar*, Colorado School of Mines (June 2010)
- Talk **A New Integral Equation Method for Direct Electromagnetic Scattering in Homogeneous Media and Its Numerical Confirmation**, *Carr Theoretical Physics Group Seminar*, Colorado School of Mines (January 2007)

Talk **A New Formulation of the Integral Equation Method for Electromagnetic Scattering**,
Summer Undergraduate Research Conference in Mathematics, The Ohio State University
(August 2003)

LANGUAGES

Bilingual English/Russian