

Shanker Balasubramaniam
Michigan State University
Department of Electrical and Computer Engineering
East Lansing, MI 48824-1226
Curriculum Vita
Revised Sept. 14, 2022

I. Personal Data

Name: Shanker Balasubramaniam
Address: 3242 Engineering Building, (517) 432-8136
Birthdate/Place: April 18, 1967, Chennai, India
Orig. Date of Employment: August 16, 2002
Citizenship: U.S.
Security Clearance: Active

II. Education

Ph. D	Engr. Sci. & Mech.	The Pennsylvania State University, University Park, PA	1993
M.S.	Engr. Sci.	The Pennsylvania State University, University Park, PA	1992
B. Tech	Mech. Engg.	Indian Institute of Technology, Madras, INDIA	1989

III. Academic Experience

Professor & Chair, Dept. Elec. and Comp. Egr. The Ohio State University	August 2022–present
University Distinguished Professor, Dept. Elec. and Comp. Egr. Michigan State University	July 2017–July 2022
University Distinguished Professor, Dept. Physics and Astronomy Michigan State University	July 2017 - present
Associate Chair for Research, Dept. Elec. and Comp. Egr. Michigan State University	Feb 2019-present
Associate Chair, Dept. Comp. Math. Sci. & Eng. Michigan State University	Aug. 2015 - June 2018
Associate Chair, Graduate Studies, Dept. Elec. and Comp. Egr. Michigan State University	Aug. 2012 - Aug. 2015

Professor, Dept. Comp. Math. Sci. & Egr Michigan State University	Oct. 2015 - Aug, 2018
Professor, Dept. Elec. and Comp. Egr. Michigan State University	Aug. 2008 - June 2017
Professor, Dept. Physics & Astronomy Michigan State University	Aug. 2009 - June 2017
Associate Professor, Dept. Elec. and Comp. Egr. Michigan State University	Aug. 2002 - 2008
Assistant Professor, Dept. Elec. and Comp. Egr. Iowa State University	Aug. 1999 - Aug. 2002
Visiting Assistant Professor/Lecturer, Dept. Elec. and Comp. Egr. University of Illinois at Urbana-Champaign	Jul. 1996 - Aug. 1999
Post-doc Research Associate, Dept. Biochem. and Biophys. Iowa State University	Aug. 1993 - Jun. 1996
Teaching/Research Assistant, Dept. Eng. Sci. and Mech. The Pennsylvania State University	Aug. 1989 - May 1993

IV. Honors

- University Distinguished Professor, July, 2017
- 2014 William J. Beal Outstanding Faculty Award (Distinguished Faculty Award)
- Sackler Fellow/Lecturer, Raymond and Mortimer Sackler Institute for Advanced Studies, Tel Aviv University, 2011
- Elected Fellow of IEEE, Class of 2010
- Withrow Senior Distinguished Research Scholar Award, 2010
- Withrow Teaching Award, 2007.
- AFOSR Summer Faculty Fellow, 2006.
- Withrow Junior Research Scholar Award, 2004.
- Elected to Senior Member, IEEE, 2003.
- Elected to Full Membership, USNC-URSI Commission B. (2002)

- First place, best student competition, Applied Computational Electromagnetics Society, 2012.
- Third Place, Best Student Paper Competition, Annual IEEE Symposium on Antennas and Propagation, 2008.
- Best Student Paper Finalist (in the top 15/200+ papers), Annual IEEE Symposium on Antennas and Propagation, 2006, 2008, 2009, 2010 (2 papers), 2011 (2 papers), 2012, 2020.
- Honorable Mention, Best student paper competition (in the top (16-30)/200+ papers), Annual IEEE Symposium on Antennas and Propagation, 2009, 2010, 2012-2014.
- Best paper finalist (top 3/200+ papers), ACM/IEEE Supercomputing Conference (SC), 2002.
- Best paper finalist, EIT 2006.
- Marquis Who is Who in Science and Engineering, 4th Edition.

V. Academic areas of specialization

Teaching (Michigan State University)

ECE 305 Electromagnetic Fields and Waves I (2002F,2006F,2007F,2009S,2012F,2016S)
 ECE 306 Electromagnetic Fields and Waves II (2003S)
 ECE 802: Section 601; Advanced Computational Methods in Electromagnetics (2003F,2007S)
 ECE 836: Computational Electromagnetics (2004S,2008F)
 ECE 835: Advanced Electromagnetics I (2004F,2005F,2008S)
 ECE 280: Electrical Engineering Analysis (2004F&S,2013F,2014S)
 ECE 802/837: Canonical Problems in Electromagnetics (2005S,2007S)
 ECE 929A: Planar Waveguides & Circuits (2005F,2009S)
 ECE 929D: Fast methods in Computational Acoustics and Electromagnetics (2009S,2011S)

Teaching (Iowa State University)

EE 512 Advanced Electromagnetic Field Theory I (1999F,2000F,2001F)
 EE 513 Advanced Electromagnetic Field Theory II (2000S)
 EE 510 Special Topics in Electromagnetics: Computational Electromagnetics (2000F)
 EE 516x Computational Electromagnetics (2001F)
 EE 313 Electromagnetics (2001S,2002S)
 EE 417/516 Antenna Theory and Design (2002S)

Teaching (University of Illinois)

ECE 420 Electromagnetic Waves and Radiating Systems (1996F,1997Su)

Research

Development of High Performance Computational Methods (includes novel differential and integral equation methods to linear algebraic methods to reduce complexity to parallel algorithms) as applied to

1. Condensed Matter Physics
2. Applied Electromagnetics
3. Frequency Domain Fast Algorithms (primarily fast multipole based)
4. Transient Analysis and Fast Time-Domain Solvers
5. Field Propagation in Complex Media
6. Modelling of Electromagnetic Properties of Composites and Thin Films
7. Non-Linear Phenomena
8. Scattering from Random Media and Rough Surfaces
9. Acoustic and Elastic Wave Propagation
10. Inverse Scattering

VI. Technical Publications

Book Chapters

1. D. Dault, J. Li, and **B. Shanker**, "New trends in geometric modeling and discretization for integral equations," in *New Trends in Computational Electromagnetics*, ed. Ozgur Ergul, SciTech Publishing, IET, pp. 315, 2020.
2. C. Fung, N. Xi, **B. Shanker**, and K. W. C. Lia, *Nano-optoelectronic Devices and Sensors*, ch. Chapter 9: Nanowire on nanoantenna based optical sensors, pp. 151–160. Elsevier, 2012.
3. E. Michielssen, **B. Shanker**, M. Lu, K. Aygün and A. A. Ergin, "Plane Wave Time Domain Algorithms and Fast Time Domain Integral Equation Solvers," in *Modern Radio Science*, Oxford, 2002.
4. **B. Shanker**, A. A. Ergin, K. Aygün and E. Michielssen, "Analysis of transient electromagnetic scattering phenomena using a two-level plane wave time domain algorithm," in *Fast Algorithms in Computational Electromagnetics*, Artech House, 2001.
5. A. A. Ergin, **B. Shanker** and E. Michielssen, "Plane wave time domain algorithm for fast analysis of transient wave phenomena," in *Fast Algorithms in Computational Electromagnetics*, Artech House, 2001.
6. V. Jandhyala, E. Michielssen, **B. Shanker**, W. C. Chew, "The steepest descent fast multipole method," in *Fast Algorithms in Computational Electromagnetics*, Artech House, 2001.
7. A. Lakhtakia and **B. Shanker**, "Beltrami fields within continuous source regions, volume integral equations, scattering algorithms, and the extended Maxwell-Garnett model," *Selected Papers on Linear Composite Optical Materials*, Milestone Volume No. 120, Bellingham, WA: SPIE Optical Engineering Press, 1996.

Refereed Journal Articles

1. A. Alsnayyan and **B. Shanker**, "Iso-geometric Integral Equation Solvers and their Compression via Manifold Harmonics," *IEEE Transactions on Antennas and Propagation*, Under review, 2021.
2. O. Ramachandran, S. O'Connor, Z. Crawford, and **B. Shanker**, "Port Parameter Extraction Based Self Consistent Coupled EM-Circuit FEM Solvers," *IEEE Transactions on Packaging*, under review, 2021.
3. A. Alsnayyan and **B. Shanker**, "Laplace-Beltrami based Multi-Resolution Shape Reconstruction on Subdivision Surfaces," *Journal of Acoustical Society of America*, under review, 2021
4. L. Baumann, C. Macon, H. M. A. Aktulga and **B. Shanker**, "Decoupled Potential Integral Equation for Electromagnetic Scattering From Arbitrarily Shaped Dielectric Objects," *IEEE Transactions on Antennas and Propagation*, under review, 2021.
5. S. O'Connor, Z. Crawford, J. Verboncoeur, J. Luginsland, and **B. Shanker**, "A set of benchmark tests for validation of 3d particle in cell methods," *IEEE Transactions on Plasmas*, **49**, 1724-1731, 2021
6. Z. D. Crawford, S. O'Connor, J. Luginsland, and **B. Shanker**, "Rubrics for charge conserving current mapping in finite element particle in cell methods," *IEEE Transactions on Plasmas*, to appear, 2021.
7. S. O'Connor, Z. D. Crawford, O. Ramachandran, J. Luginsland, and **B. Shanker**, "Time integrator agnostic charge conserving finite element pic," *Physics of Plasmas*, to appear, 2021.
8. S. O'Connor, Z. D. Crawford, O. Ramachandran, J. Luginsland, and **B. Shanker**, "Quasi-Helmholtz Decomposition, Gauss' Laws and Charge Conservation for Finite Element Particle-in-Cell," *Computer Communications in Physics*, to appear, 2021.
9. Z. D. Crawford, O. Ramachandran, S. O'Connor, J. Luginsland, and **B. Shanker**, "Higher order charge conserving Finite Element PIC," *IEEE Transactions on Plasmas*, under review, 2021.
10. Z. D. Crawford, O. Ramachandran, S. O'Connor, J. Luginsland, and **B. Shanker**, "Charge conserving finite element domain decomposition accelerated PIC," *IEEE Transactions on Plasmas*, under review, 2021.
11. O. Ramachandran, Z. D. Crawford, S. O'Connor, J. Luginsland, and **B. Shanker**, "A finite element envelope tracking approach for PIC simulations," *IEEE Transactions on Plasmas*, under review, 2021.
12. M. P. Lingg, S. M. Hughey, H. M. Aktulga, and **B. Shanker**, "High performance evaluation of Helmholtz potentials using the multi-level fast multipole algorithm," *IEEE Transactions on Parallel Computing*, under review, 2021.
13. X. Wang, Y. Shi, M. Lu, **B. Shanker**, E. Michielssen, and H. Bagcı, "Stable and Accurate Marching-on-in-Time Solvers of Time Domain EFIE, MFIE, and CFIE based on Quasi-Exact Integration Technique," *IEEE Transactions on Antennas and Propagation*, Oct., 2020.

14. S Hughey, A. Alsnayyan, H. M. Aktulga, T. Gao, and **B Shanker**, "Fast and scalable evaluation of pairwise potentials," *Computer Physics Communications*, 255, 107248, 2020.
15. A. M. A. Alsnayyan, J Li, S Hughey, A Diaz, and **B Shanker**, "Efficient isogeometric boundary element method for analysis of acoustic scattering from rigid bodies," *The Journal of the Acoustical Society of America*, **147**, 3275-3284, 2020.
16. C. Glosser, E. Lu, T. J. Bertus, C. Piermarocchi, and **B. Shanker**, "Acceleration techniques for semiclassical Maxwell-Bloch systems: An application to discrete quantum dot ensembles," *Computer Physics Communications*, **258**, 107500, 2020.
17. Z. Crawford, J. Li, A. J. Christlieb, and **B. Shanker**, "Unconditionally Stable Time Stepping Method for Mixed Finite Element Maxwell Solvers," *Progress in Electromagnetics Research*, **103**, 17-30, 2020.
18. J. Li, X. Fu, and **B. Shanker**, "Decoupled potential integral equations for electromagnetic scattering from dielectric objects," *IEEE Transactions on Antennas and Propagation*, **67**, 1729-1739, 2019.
19. S.Hughey, H.Aktulga, M.Vikram, M.Lu, **B.Shanker**, and E.Michielsen, "Parallel wideband mlfma for analysis of electrically large, non-uniform, multiscale structures," *IEEE Transactions on Antennas and Propagation*, **67**, 1094-1107, 2019.
20. S. O'Connor, S. Hughey, D. Dault, A. J. Pray, J. M. Villa-Giron, and **B. Shanker**, "A novel port/network parameter extraction technique for coupling circuits with full-wave time-domain integral equation solvers," *IEEE Transactions on Microwave Theory and Techniques*, **67**, 553-564, 2019.
21. J. Li, X. Fu, and **B. Shanker**, "Formulation and iso-geometric analysis of scalar integral equations for electromagnetic scattering," *IEEE Transactions on Antennas and Propagation*, vol. 66, no. 4, pp. 1957– 1966, 2018
22. Junyan Tang, Amin Tayebi, Benjamin Crowgey, Edward J Rothwell, **Balasubramaniam Shanker**, Leo C Kempel, Michael J Havrilla, "Characterization of Y-Bias Ferrite Materials for Tunable Antenna Applications Using a Partially Filled Rectangular Waveguide," *IEEE Transactions on Antennas and Propagation*, **65**, 5279-5288, 2017.
23. Xin Fu, Jie Li, Li Jun Jiang, and **Balasubramaniam Shanker**, "Generalized Debye Sources-Based EFIE Solver on Subdivision Surfaces," *IEEE Transactions on Antennas and Propagation*, **65**, 5376-5386, 2017.
24. Connor Glosser, **B Shanker**, and Carlo Piermarocchi, "Collective Rabi dynamics of electromagnetically coupled quantum-dot ensembles," *Physical Review A*, **96**, 033816, 2017.
25. D. Dault and **B. Shanker**, "A Mixed Potential MLFMA for Higher Order Moment Methods with Application to the Generalized Method of Moments," *IEEE Transactions on Antennas and Propagation*, **64**, 650-662, 2016.
26. Jie Li, Daniel Dault, Beibei Liu, Yiying Tong, and **B. Shanker**, "Subdivision based isogeometric analysis technique for electric field integral equations for simply connected structures," *Journal of Computational Physics*, **319**, 145-162, 2016.

27. Connor Glosser, Carlo Piermarocchi, Jie Li, Dan Dault, and **B. Shanker**, "Computational dynamics of acoustically driven microsphere systems," *Physical Review E*, **93**, 013305, 2016.
28. Z. Crawford, D. Dault, and **B. Shanker**, "Smooth Surface Blending for the Generalized Method of Moments," *IEEE Antennas Wireless and Propagation Letters*, **15**, 528-531, 2016.
29. J. Lie and **B. Shanker**, "Time-Dependent Lorentz-Mie-Debye Formulation for Electromagnetic Scattering from Dielectric Spheres," **154**, 195–208, 2015; Invited paper for special issue on 150-years of Maxwell's birth.
30. C. S. Meierbachtol, A. D. Greenwood, J. P. Verboncoeur, and **B. Shanker**, "Conformal Electromagnetic Particle in Cell: A Review," *IEEE Transactions on Plasma Science*, **43**, 3778-3793, 2015.
31. D. Dault and **B. Shanker**, "Method of Moments: As Applied to the Solution of Electromagnetic Integral Equations," *Wiley Encyclopedia of Electrical and Electronics Engineering*, 1–20, 2015.
32. J. Li and **B. Shanker**, "Time-Dependent Debye–Mie Series Solutions for Electromagnetic Scattering," *IEEE Transactions on Antennas and Propagation*, **63**, 3644 - 3653, 2015.
33. D. Dault and **B. Shanker**, "An Interior Penalty Method for the Generalized Method of Moments," *IEEE Transactions on Antennas and Propagation*, **63**, 3561 - 3568, 2015.
34. B. R. Crowgey, J. Tang, E. J. Rothwell, **B. Shanker**, and L. C. Kempel, "A Waveguide Verification Standard Design Procedure for the Microwave Characterization of Magnetic Materials," *Progress In Electromagnetics Research*, **150**, 29–40, 2015.
35. J. Li, D. Dault, and **B. Shanker**, "Analysis of scattering from complex dielectric objects using the generalized method of moments," *Journal of the Optical Society of America: A*, **31**, 2346-2355, 2014.
36. A. J. Pray, N. V. Nair, Y. begin, K. Cools, H. Bagci and **B. Shanker**, "A Stable Higher Order Space-Time Galerkin Scheme for Time Domain Integral Equations," *IEEE Transactions on Antennas and Propagation*, **62**, 6183-6191, 2014.
37. J. Li, D. Dault, and **B. Shanker**, "A Quasianalytical Time Domain Solution for Scattering from a Homogeneous Sphere," *Journal of Acoustical Society of America*, **135**, 1676-1685, 2014.
38. D. Dault, N. V. Nair, and **B. Shanker**, "The Generalized Method of Moments for Electromagnetic Boundary Integral Equations," *IEEE Transactions on Antennas and Propagation*, **62**, 3174 - 3188, 2014.
39. N. Miller, A. Baczewski, **B. Shanker**, and J. A. Albrecht, "A Discontinuous Galerkin Time Domain Framework for Periodic Structures Subject To Oblique Excitation," *IEEE Transactions on Antennas and Propagation*, 2014.
40. O. Tuncer, **B. Shanker**, and L. C. Kempel, "A Hybrid Vector Generalized Finite Element Method for Transient Electromagnetic Simulations," *Electromagnetics*, **34**, 286-297, 2014.

41. O. Tuncer, **B. Shanker**, and L. C. Kempel, "Discontinuous Galerkin Inspired Framework for Vector Generalized Finite Element Methods," *IEEE Transactions on Antennas and Propagation*, **62**, 1339 - 1347, 2014.
42. Junyan Tang, Benjamin Crowgey, Ozgur Tuncer, Edward Rothwell, **B. Shanker**, Leo Kempel, and Michael Havrilla, "Characterization of Biaxial Materials Using a Partially-Filled Rectangular Waveguide," *Applied Computational Electromagnetics Journal*, 2013.
43. B. R. Crowgey, O. Tuncer, T. Junyan, E. J. Rothwell, **B. Shanker**, L. C. Kempel and M. J. Havrilla, "Characterization of Biaxial Anisotropic Material Using a Reduced Aperture Waveguide," *IEEE Transactions on Instrumentation and Measurement*, **62**, 2739-2750, 2013.
44. N. V. Nair, A. J. Pray, J. Villa-Giron, **B. Shanker**, and D. H. Wilton, "A Singularity Cancellation Technique on Arbitrary Higher Order Surface Descriptions," *IEEE Transactions on Antennas and Propagation*, **61**, 2347 - 2352, 2013.
45. A. D. Baczewski, D. L. Dault and **B. Shanker**, "Accelerated Cartesian Expansions for the Rapid Solution of Periodic Multiscale Problems," *IEEE Transactions on Antennas and Propagation*, **60**, 4281 -4290, 2012.
46. A. D. Baczewski, N. Miller and **B. Shanker**, "Rapid analysis of scattering from periodic dielectric structures using accelerated Cartesian expansions," *Journal of Optical Society of America: A*, **29**, 531-540, 2012.
47. A. J. Pray, N. V. Nair, and **B. Shanker**, "Stability Properties of the Time Domain Electric Field Integral Equation Using a Separable Approximation for the Convolution with the Retarded Potential," *IEEE Transactions on Antennas and Propagation*, **60**, 3772-3781, 2012.
48. N. V. Nair, **B. Shanker**, and L. C. Kempel, "Generalized method of moments: A boundary integral framework for adaptive analysis of acoustic scattering," *Journal of the Acoustical Society of America*, **132**, 1261-1270, 2012.
49. O. Tuncer, **B. Shanker**, and L.C. Kempel, "Tetrahedral-based vector generalized finite element method and its applications," *IEEE Antennas and Wireless Propagation Letters*, *IEEE*, vol. 11, pp. 945 -948, 2012.
50. N. Nair and **B. Shanker**, "Generalized Method of Moments: A Novel Discretization Technique for Integral Equations," *Trans IEEE Trans. Antennas and Propagation.*, **59**, 2280-2293, 2011.
51. M. Vikram, S. K. Seal, **B. Shanker** and S. Aluru, "A Scalable Parallel Wideband MLFMA for Efficient Electromagnetic Simulations on Large Scale Clusters," *Trans IEEE Trans. Antennas and Propagation.*, **59**, 2565-2577, 2011.
52. N. V. Nair and **B. Shanker**, "Generalized method of moments: A novel framework for analyzing scattering from homogeneous dielectric bodies," *Journal of the Optical Society of America: A*, **28**, 328-340, 2011
53. M. Vikram, A. Baczewski, **B. Shanker** and L. C. Kempel, "Accelerated Cartesian Expansion (ACE) based unified framework for rapid evaluation of potentials associated with the diffusion, lossy wave and Klien Gordon equations," *Journal of Computational Physics*, **229**, 9119-9134, 2010.

54. O. Tuncer, C. Lu, N. Nair, **B. Shanker** and L. C. Kempel, "Further Development of Vector Generalized Finite Element Method and Its Hybridization With Boundary Integrals," *IEEE Trans. Antennas and Propagation*, **58**, 887 - 899, 2010.
55. M. Vikram, **B. Shanker**, and T. Van, "A Novel Wideband FMM for Fast Integral Equation Solution of Multiscale Problems in Electromagnetics," *IEEE Trans. Antennas and Propagation*, **57**, 2094-2104, 2009.
56. **B. Shanker**, M. Lu, J. Yuan, and E. Michielssen, "Time domain integral equation analysis of scattering from composite bodies via exact evaluation of radiation fields," *IEEE Transactions on Antennas and Propagation*, **57**, 1506-1520, 2009.
57. M. Vikram and **B. Shanker**, "An incomplete review of Fast Multipole Methods—from static to wideband— as applied to problems in computational electromagnetics," *Applied Computational Electromagnetics Society Journal*, **24**, 79-108, 2009.
58. C. K. M. Fung, N. Xi, **B. Shanker**, and K. W. C. Lai, "Nanoresonant signal boosters for carbon nanotube based infrared detectors," *Nanotechnology*, **20**, 2009.
59. M. Khan, T. P. Hogan and **B. Shanker**, "Gold-coated zinc oxide nanowire-based substrate for surface-enhanced Raman spectroscopy," *Journal of Raman Spectroscopy*, **40**, 1539 - 1545, 2009.
60. D. Chen, **B. Shanker**, and R. McGough, "Numerical evaluation of potentials," *International Journal of Applied Electromagnetics and Mechanics*, **28**, 11-15, 2008.
61. M. A. Khan, T. Hogan and **B. Shanker**, "Surface-enhanced Raman scattering from gold-coated germanium oxide nanowires," *J. Raman Spect*, **39**, 893-900, 2008.
62. M. Vikram and **B. Shanker**, "Fast Evaluation of Time Domain Fields in Sub-Wavelength Source/Observer Distributions using Accelerated Cartesian Expansions (ACE)," *J. Comp. Phys.*, **227**, 1007–1023, 2007.
63. **B. Shanker** and H. Huang, "Accelerated Cartesian Expansions: An $\mathcal{O}(N)$ method for rapid computation of potentials of the form R^ν for all real ν ," *J. Comp. Phys.*, **226**, 732-753, 2007.
64. C. Lu and **B. Shanker**, "Generalized Finite Element Method for Vector Electromagnetic Problems," *IEEE Transactions on Antennas and Propagation*, **55**, 1369-1381, 2007.
65. C. Lu and **B. Shanker**, "Hybrid Boundary Integral-Generalized (Partition of Unity) Finite-Element Solvers for the Scalar Helmholtz Equation," *IEEE Transactions on Magnetics*, **43**, 1002 - 1012, 2007.
66. J. Gao and **B. Shanker**, "Time Domain Weyl's Identity and the Causality Trick Based Formulation of the Time Domain Periodic Green's Function," *IEEE Transactions on Antennas and Propagation*, **55**, 1656 - 1666, 2007.
67. **B. Shanker**, M. Lu, A. A. Ergin, and E. Michielssen, "Plane-wave time-domain accelerated radiation boundary kernels for FDTD analysis of 3-D electromagnetic phenomena," *IEEE Transactions on Antennas and Propagation*, **53**, 3704 - 3716, 2005.

68. G. Kobidze, **B. Shanker** and D. P. Nyquist, "Novel algorithm for analysis of surface plasmon polariton," *Physical Review E*, **72**,056702, 2005.
69. N-W. Chen, M. Lu, F. Capolino, **B. Shanker** and E. Michielssen, "Floquet-wave-based Analysis of Transient Scattering from Doubly Periodic Discretely Planar, perfectly conducting structures," *Radio Sci.*, **40**, RS4007, 2005.
70. G. Kobidze, G. Jun, **B. Shanker** and E. Michielssen, "Fast scheme for analyzing transient scattering from dispersive media," *IEEE Trans. Antennas Propagat.*, **53**, 1215 - 1226, 2005
71. L. Xuan, Z. Zheng, **B. Shanker** and L. Udpa, "Meshless Method for Numerical Modeling of Pulsed Eddy Currents," *IEEE Transactions on Magnetics*, **40**, 3457-3462, 2004.
72. R. A. Wildman, G. Pisharody, D. S. Weile, **B. Shanker**, E. Michielssen, "An Accurate Scheme for the Solution of the Time-Domain Integral Equations of Electromagnetics Using Higher Order Vector Bases and Bandlimited Extrapolation," *IEEE Transactions on Antennas and Propagation*, **52**, 2973 - 2984, 2004.
73. G. Kobidze and **B. Shanker**, "Fast computational scheme for analyzing scattering from inhomogeneous anisotropic bodies," *IEEE Trans. Antennas and Propagation*, **52**, 2650-2658, 2004
74. **B. Shanker**, K. Aygün and E. Michielssen, "Fast Transient Analysis of Scattering from Lossy Inhomogeneous Dielectric Bodies," *Radio Science*, **39**, 1-14, 2004.
75. M. Lu, **B. Shanker**, and E. Michielssen, "Elimination of spurious solutions associated with exact transparent boundary conditions in FDTD solvers," *IEEE Antennas and Wireless Propagation Letters*, **3**, 59-62, 2004
76. M. Lu, M. Lv, A. A. Ergin, **B. Shanker**, and E. Michielssen, "Multilevel plane wave time domain-based global boundary kernels for two-dimensional finite difference time domain simulations," *Radio Science*, **39**, 2004.
77. L. Xuan, **B. Shanker**, Z. Zeng, and L. Udpa, "Element-free Galerkin method for static and quasi-static electromagnetic field computation," *IEEE Transactions on Magnetics*, **40**, 12 - 20, Jan. 2004
78. K. Aygün, B.C.Fisher, J.Meng, **B.Shanker** and E.Michielssen, "A Fast Hybrid Field-Circuit Simulator For Transient Analysis Of Microwave Circuits," *IEEE Transactions on Microwave Theory and Techniques*, **52**, 573 - 583, 2004
79. M. Lu, K. Yegin, **B. Shanker**, and E. Michielssen, "Fast time domain integral equation solvers for analyzing two-dimensional scattering phenomena; Part I: temporal acceleration," *Electromagnetics*, **24**, no. 6, pp. 425-449, 2004.
80. M. Lu, **B. Shanker**, and E. Michielssen, "Fast time domain integral equation solvers for analyzing two-dimensional scattering phenomena; Part II: full PWTd acceleration," *Electromagnetics*, **24**, no. 6, pp. 451-470, 2004.
81. D. S. Weile, G. Pisharody, N-W. Chen, **B. Shanker**, and E. Michielssen, "An Exponentially Convergent Scheme for the Solution of the Time-Domain Integral Equations of Electromagnetics," *IEEE Transactions on Antennas and Propagation*, **52**, 283 - 295, 2004

82. L. Xuan, Z. Zeng, **B. Shanker** and L. Udpa, Element-Free Galerkin Method in Pulsed Eddy Currents, *Journal of Applied Electromagnetics and Electromechanics*, **19**, No. 1-4, pp. 463-466, 2004.
83. N. Chen, **B. Shanker**, and E. Michielssen, "Integral-equation-based analysis of transient scattering from periodic perfectly conducting structures," *IEE proceedings-Microwaves, Antennas and Propagation*, **150**, 120-124, 2003.
84. **B. Shanker**, A. A. Ergin, M. Lu and E. Michielssen, "Fast analysis of transient electromagnetic scattering phenomena using the multilevel plane wave time domain algorithm, *IEEE Trans. Antennas and Propagat.*, **51**, 628-641, 2003.
85. S. Balasubramanian, S. N .Lalgudi, and **B. Shanker**, "Fast-integral-equation scheme for computing magnetostatic fields in nonlinear media," *IEEE Transactions on Magnetics*, **38**, pp. 3426-3432, 2002.
86. D. Jiao, A. A. Ergin, **B. Shanker**, E. Michielssen and J. M. Jin, "A fast higher-order time-domain finite element-boundary integral method for 3-D electromagnetic scattering analysis," *IEEE Transactions on Antennas and Propagation*, **50**, pp. 1192 -1202, 2002.
87. K. Aygün, **B. Shanker**, and E. Michielssen, "Fast time-domain characterization of finite size microstrip structures," *International Journal of Numerical Modelling: Electronic Networks, Devices and Fields*, **15**, pp. 439-457, 2002.
88. A. Yilmaz, D. S. Weile, **B. Shanker**, J. M. Jin and E. Michielssen, "Fast Analysis of Transient Scattering in Lossy Media," **1**, 14-17, *IEEE Antennas and Propagation Letters*, 2002.
89. **B. Shanker**, A. A. Ergin and E. Michielssen, "Analysis of transient scattering from penetrable bodies using using the multilevel plane wave time domain algorithm," *J. Opt. Soc. Am. A*, **19**, 716-726, 2002.
90. K. Aygün, **B. Shanker**, A. A. Ergin, and E. Michielssen, "A Two-Level Plane Wave Time Domain Algorithm for Fast Analysis of EMC/EMI Problems," *IEEE Trans. EMC*, **44**, 152-164, 2002.
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93. N. V. Nair and **B. Shanker**, "An *hp*-refinement scheme for surface integral equations using the generalized method of moments," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, 2012.
94. N. Nair, A. Pray, J. Villa-Giron, **B. Shanker**, and D. Wilton, "A singularity cancellation technique on arbitrary higher order patch descriptions," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, pp. 1–2, July 2012.
95. A. Pray, N. Nair, and **B. Shanker**, "A stable higher order tdie solver using a separable approximation for convolution with the retarded potential," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, pp. 1–2, July 2012.
96. A. J. Pray, N. V. Nair, and **B. Shanker**, "Time domain integral equation solver for composite scatterers using a separable expansion for convolution with the retarded potential," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, 2012.
97. A. J. Pray, N. Nair, and **B. Shanker**, "Construction of an *hp*-refinement technique for transient scattering using the generalized method of moments," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, 2012.
98. A. J. Pray, N. V. Nair, and **B. Shanker**, "A stable higher order time domain electric field integral equation solver," in *Proceedings of the 28th Annual Review of Progress in Applied Computational Electromagnetics*, 2012.
99. A. Pray, N. Nair, and **B. Shanker**, "Time domain integral equation solver for composite scatterers using a separable expansion for convolution with the retarded potential," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, pp. 1–2, July 2012.
100. J. Tang, B. Crowgey, O. Tuncer, E. Rothwell, **B. Shanker**, L. Kempel, and M. Havrilla, "Characterization of biaxial materials using a partially filled rectangular waveguide," in *AMTA 2012 Antenna Measurement Techniques Association Symposium*, 2012.
101. O. Tuncer, **B. Shanker**, and L. C. Kempel, "Development of time domain discontinuous galerkin-vector generalized finite element method," in *11th International Workshop on Finite Elements for Microwave Engineering*, 2012.
102. O. Tuncer, **B. Shanker**, and L. Kempel, "A discontinuous galerkin framework for hybridizing vgfem and fem," in *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE*, pp. 1–2, July 2012.
103. Meierbachtol, C.S., Nair, N., Grotjohn, T.A., **Shanker, B.**, "Modeling of Convective Plasma Flow in High Pressure Microwave PACVD Diamond Reactors," 2011 IEEE International Conference on Plasma Science (ICOPS), Chicago, IL, 2011.

104. Meierbachtol, C.S., Nair, N.V., Grotjohn, T.A., **Shanker, B.**, "Self-Consistent Convective Plasma Flow Model for High Pressure MPACVD Diamond Reactors," 2011 New Diamond and Nano Carbons International Symposium, Matsue, Japan, 2011.
105. N. Nair, **B. Shanker** and L. C. Kempel, "Generalized Method of Moments: A flexible discretization scheme for integral equations using locally smooth surface approximations," IEEE COMCAS 2011. **Invited**
106. Andrew Baczewski, and **B. Shanker**, "Applications of Periodic Accelerated Cartesian Expansions to the Analysis of Electrically Dense Frequency Selective Surfaces," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011. **Best Student Paper Finalist**
107. Andrew J. Pray, Naveen V. Nair, and **B. Shanker**, "A Separable Approximation for Convolution with the Retarded Green's Function and Its Application to Time Domain Integral Equations," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011. **Best Student Paper Finalist**
108. Naveen V. Nair, **B. Shanker**, and Leo C. Kempel, "A Novel Discretization Scheme for Electromagnetic Integral Equations Using the Generalized Method of Moments and Locally Smooth Surface Approximation," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
109. Naveen V. Nair, **B. Shanker**, and Leo C. Kempel, "A Discretization Framework for Scalar Integral Equations Using the Generalized Method of Moments and Locally Smooth Surface Approximations," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
110. Ozgur Tuncer, **B. Shanker**, and Leo C. Kempel, "Development of Time Domain Vector Generalized Finite Element Method," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
111. Daniel Dault, **B. Shanker**, Andrew Baczewski, and Prem Chahal, "Modeling of Dense Coupled Periodic and Non-Periodic Electromagnetic-Circuit Systems Using Harmonic Balance and Fast Solvers," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
112. Ozgur Tuncer, **B. Shanker**, and Leo C. Kempel, "A Hybrid Discontinuous Galerkin-Vector Generalized Finite Element Method for Electromagnetics," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
113. Ozgur Tuncer, Funda Ozge Sahin, **B. Shanker**, and Leo C. Kempel, "Vector Generalized Finite Element Method on Tetrahedral Meshes and Applications of Its Features in Electromagnetic Simulations," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
114. Daniel Dault, Andrew Baczewski, Prem Chahal, and **B. Shanker**, "A Fast Method for Evaluating Convolutions with the Time Domain Periodic Green's Function," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
115. Naveen V. Nair, **B. Shanker**, and Leo C. Kempel, "Locally Smooth Surface Meshes for Electromagnetic and Acoustic Integral Equations," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.

116. Andrew Baczewski, Naveen V. Nair, Daniel Dault, and **B. Shanker**, "Towards Integral Equation Methods for Periodic Structures with Finite Perturbations Using Accelerated Cartesian Expansions," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
117. C. S. Meierbachtol, Prem Chahal, and **B. Shanker**, "Simulation of a Plasmonic HEMT Terahertz Sensor," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
118. N. V. Nair, **B. Shanker** and A. Boag, "Novel Representation of the Retarded and the Helmholtz Potential, and Development of Corresponding Accelerators," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
119. Andrew J. Pray, Naveen V. Nair, Melapudi Vikram, Minyu Lu, **B. Shanker** and E. Michielssen, "A Parallel Implementation of the PWTD Algorithm for Time-Domain Electromagnetic Simulations," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
120. Benjamin Crowgey, Edward Rothwell, **B. Shanker**, and Leo C. Kempel, "Raoul Ouedraogo Error Analysis of a Waveguide Verification Standard Used in the Characterization of Materials," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
121. Benjamin Crowgey, Edward Rothwell, **B. Shanker**, Leo C. Kempel, Ozgur Tuncer, and Mike Havrilla, "Characterization of Biaxial Anisotropic Material Using a Reduced Aperture Waveguide," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
122. C. S. Meierbachtol, Naveen V. Nair, T. A. Grotjohn, and **B. Shanker**, "Multi-Physics Modeling of a Microwave Plasma-Assisted Chemical Vapor Deposition Reactor for Diamond Growth," Proceedings of the 2011 IEEE Antennas and Propagation Symposium, July, 2011.
123. M. Vikram, C. Knowles, **B. Shanker** and L. C. Kempel, "An Ultra-Wideband FMM for Multi-scale Electromagnetic Simulations," Proceeding of the Applied Computational Electromagnetics Symposium. **Invited**
124. O. Tüncel, **B. Shanker** and L. C. Kempel, "Time Domain Vector Generalized Finite Element Method," Proceedings of the 10th Finite Element Workshop, October 2010.
125. A. D. Baczewski, N. V. Nair, and **B. Shanker**, "Integral Equation Methods for Finite Sources in Periodic Structures with Applications to Nanophotonics," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
126. A. J. Pray, N. V. Nair, and **B. Shanker**, "Accurate Evaluation of Retarded Potential Integrals," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
127. A. D. Baczewski, D. Dault, and **B. Shanker**, "Computational Analysis of Optical Field Enhancement in Disordered Nanoscale Structures with Applications to Surface Enhanced Raman Spectroscopy," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
128. B. R. Crowgey, E. J. Rothwell, **B. Shanker**, and L. C. Kempel, "Verification Standards for Waveguide Characterization of Materials," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.

129. M. Vikram, M. Lu, **B. Shanker** and E. Michielssen, "A Parallel Implementation of the PWTD Algorithm for Time- Domain Electromagnetic Simulations," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
130. N. V. Nair, A. J. Pray, and **B. Shanker** "Analysis of Transient Scattering from PEC Objects Using the Generalized Method of Moments," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010. **Best Student Paper Finalist**
131. N. V. Nair and **B. Shanker**, "A Generalized Method of Moments Based Discretization of the Mueller Integral Formulation," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
132. A. D. Baczewski and **B. Shanker**, "An $O(N)$ Method for the Rapid Analysis of Periodic Problems Using Accelerated Cartesian Expansions (ACE)," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010. **Best Student Paper Finalist**
133. O. Tüncer, **B. Shanker**, and L. C. Kempel, "VGFEM with Perfectly Matched Layers," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
134. O. Tüncer, **B. Shanker**, L. C. Kempel, "A Hybrid Finite Element-Vector Generalized Finite Element Method for Electromagnetics," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
135. C. S. Meierbachtol, T. D. Brown, P. Chahal, and **B. Shanker**, "Development of a Novel HEMT-Based Plasmonic Sensor," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
136. M. Vikram, **B. Shanker** and L. C. Kempel, "A Parallel Implementation of the Surface Integral Equation (SIE) Based Electromagnetic Solver for Simulation of Complex Dielectric Objects," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
137. O. Tüncer, **B. Shanker**, L. C. Kempel, "Development of Domain Decomposition for Vector Generalized Finite Element Method," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
138. A. D. Baczewski, D. Dault, **B. Shanker** and P. Chahal, " Modeling of Coupled FSS-Circuit Systems Using Harmonic Balance and a Fast, Periodic Boundary Integral Solver," Proceedings of the 2010 IEEE Antennas and Propagation Symposium, July, 2010.
139. M. Vikram, A. Baczewski, **B. Shanker**, and S. Aluru, "Parallel accelerated Cartesian expansions for particle dynamics simulations, " IEEE International Symposium on Parallel & Distributed Processing, 23-29 May 2009 Page(s):1 - 11.
140. O. Tuncer, **B. Shanker** and L. C. Kempel, "Hybrid generalized finite element-boundary integral method for aperture design," 3rd European Conference on Antennas and Propagation, March 2009. **Invited**
141. M. Vikram, **B. Shanker** and T. Van, "Application of Wideband FMM for Solution of Multiscale Multiregion Electromagnetic Simulations," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009.

142. O. Tuncer, **B. Shanker** and L. C. Kempel, "A Vector Generalized Finite Element-Boundary Integral Formulation for Scattering from Cavity-Backed Apertures," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009.
143. M. Vikram, **B. Shanker** and S. Aluru, "Provably Scalable Parallel FMM Algorithm for Multiscale Electromagnetic Simulations," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009.
144. M. Vikram, **B. Shanker** and M. Lu, "Ultra Wideband-FMM: a Fast Method for Large Multiscale Electromagnetic Simulation," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009.
145. A. D. Baczewski, **B. Shanker**, L. C. Kempel, and T. P. Hogan, "Simulated Surface Enhanced Raman Spectroscopy via Scattering on a Dense, Randomly-Oriented, Array of Nanostructures," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009. **Best Student Paper finalist.**
146. O. Tuncer, **B. Shanker**, L. C. Kempel, "Development of Vector Basis Functions in Vector Generalized Finite Element Method for Inhomogeneous Domains," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009.
147. N. V. Nair and **B. Shanker**, "Implementation of Generalized Method of Moments," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009.
148. N. V. Nair and **B. Shanker**, "An Accurate and Low-Frequency Stable Discretization Scheme for the Electric Field Integral Equation Using the Generalized Method of Moments," Proceedings of the 2009 IEEE Antennas and Propagation Symposium, July, 2009. **Honorable Mention:** Best Student Paper Competition.
149. N. V. Nair, M. Vikram, and **B. Shanker**, "A robust generalized method of moments scheme for electromagnetic analysis," 25th Annual Review of Progress in Applied Computational Electromagnetics, March 2009. **Invited**
150. O. Tuncer, **B. Shanker** and L. C. Kempel, "A vector generalized finite element-boundary integral formulation," 25th Annual Review of Progress in Applied Computational Electromagnetics, March 2009. **Invited.**
151. M. Vikram, **B. Shanker** and S. Aluru, "Large-scale parallel electromagnetic solver for multiscale simulations," 25th Annual Review of Progress in Applied Computational Electromagnetics, March 2009. **Invited**
152. L. C. Kempel, **B. Shanker**, J. Xiao and S. Schnieder, "Radiation by a Magneto-Dielectric Loaded Patch Antenna," 2009 Loughborough Antennas & Propagation Conference, Nov. 2009, **Invited**
153. C.K.M. Fung, Ning Xi, B. Shanker, King Wai Chiu Lai and Hongzhi Chen, "Dipole and bowtie nano-antenna for carbon nanotube (CNT) based infrared sensors," IEEE Nanotechnology Materials and Devices Conference, 2009. NMDC '09.
154. M. Archbold, E. Rothwell, L. C. Kempel, **B. Shanker**, S. Schneider, and J. McCann, "Controlling the Main Beam of a Half-Width Microstrip Leaky-Wave Antenna by Edge Loading using

- the Transverse Resonance Method,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
155. J. Villa-Giron, **B. Shanker** and L. C. Kempel, “Modal Solution for the Fields due to a Magnetic Source Impressed in a Circular Cylinder,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 156. O. Tuncer, N. Nair, **B. Shanker** and L. C. Kempel, “Dispersion Analysis in Scalar Generalized Finite Element Method,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 157. N. V. Nair and **B. Shanker**, “A Generalized Solution scheme for Integral Equations,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 158. A. Baczewski, M. Vikram, **B. Shanker** and L. C. Kempel, “Fast Methods for the Evaluation of the Diffusion Kernel with Potential Extensions to the Dissipative Kernel,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 159. O. Tuncer, **B. Shanker** and L. C. Kempel, “Hybrid Generalized Finite Element Boundary Integral Technique,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 160. N. Nair, M. Vikram, and **B. Shanker** “Mathematical Analysis of the Augmented Electric Field Integral Equation Operators,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 161. M. Vikram, **B. Shanker**, and E. Michielssen, “Fast Evaluation of Transient Fields in Sub- to Long-Wavelength Source/Observer Distributions,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 162. M. Vikram, **B. Shanker** and A. Aluru, “Provably Optimal Parallel Fast Solver for Electromagnetic Simulations,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008.
 163. M. Vikram, **B. Shanker**, and T. Van, “Fast Solvers for Electromagnetic Simulation of Mixed-Scale Structures,” Proceedings of the 2008 IEEE Antennas and Propagation Symposium, July, 2008, **Best Student Paper Finalist (3rd place winner)**.
 164. J. Gao and **B. Shanker**, “Time domain Weyl’s identity and transient modes due to dipoles periodically distributed over a half space,” **Invited Paper**, URSI GA, 2008.
 165. C. K. M. Fung, Ning Xi, **B. Shanker**, King Wai Chiu Lai, Jiangbo Zhang, Hongzhi Chen and Yilun Luo, “Design and Fabrication of Nano Antenna for Carbon Nanotube Infrared Detector,” 8th IEEE Conference on Nanotechnology, 2008. NANO '08, Aug 18-21, pp 205-208.
 166. O. Tuncer, C. Lu, N. Nair, **B. Shanker**, and L. C. Kempel, “Recent developments in the theory and application of the generalized finite element method,” **Invited Paper**, The 9th International Workshop on Finite Elements for Microwave Engineering, May 2008
 167. N.V. Nair, M. Vikram, **B. Shanker**, L. C. Kempel, “Generalized Method of Moments for Analysis of Structures with Mixed Feature Sizes,” 2nd European Conference on Antennas and Propagation, Nov. 11-16, 2007 (**invited**).

168. J. Villa-Giron, **B. Shanker**, and L. C. Kempel, "Conformal Apertures on Singly-Curved Surfaces," 2nd European Conference on Antennas and Propagation, Nov. 11-16, 2007 (**invited**).
169. N. V. Nair, C. Lu and **B. Shanker**, "Differential and integral equation solvers based on generalized moments and partitions of unity," International conference on electromagnetics and advanced applications, Sept. 17-21, 2007 (**invited**).
170. O. Tuncer, C. Lu, N. V. Nair, **B. Shanker**, and L. C. Kempel, "Analysis of error propagation in vector generalized finite element methods," International conference on electromagnetics and advanced applications, Sept. 17-21, 2007 (**invited**).
171. M. Vikram, H. Griffith, H. Huang, **B. Shanker**, "Accelerated cartesian harmonics for rapid computation of time and frequency domain low-frequency kernels," 2007 International Symposium on Antennas and Propagation, June 10-15, 2007.
172. N. V. Nair and **B. Shanker**, "Development of generalized method of moments," International Symposium on Electromagnetic Theory, Ottawa, July 26-28, 2007.
173. J. Villa-Giron, **B. Shanker** and L. C. Kempel, "Hybrid finite element analysis of non-resonant antennas," International Symposium on Electromagnetic Theory, Ottawa, July 26-28, 2007.
174. M. Vikram and **B. Shanker**, "Eigenvalue analysis of the single integral equation," International Symposium on Electromagnetic Theory, Ottawa, July 26-28, 2007.
175. C. Lu and **B. Shanker**, "Transient analysis of electromagnetic fields using generalized finite element methods," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
176. J. Gao and **B. Shanker**, "Approximate closed form solutions to radiation by a periodic dipole array over a layered medium," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007. (**invited**)
177. O. Tuncer, C. Lu, **B. Shanker** and L. C. Kempel, "Dispersion analysis of vector generalized finite element method," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
178. C. Lu and **B. Shanker**, "Analysis of complex structures using generalized finite element methods," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
179. N. V. Nair and **B. Shanker**, "A generalized method of moments solution to vector integral equation operators," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
180. N. V. Nair and **B. Shanker**, "Application of the generalized method of moments to augmented integral operators," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
181. H. Huang and **B. Shanker**, "Accelerated Cartesian harmonics for the rapid computation of the shielded Coulomb potential," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
182. M. Vikram, H. Huang, and **B. Shanker**, "Fast evaluation of frequency domain fields in subwavelength structures using accelerated cartesian harmonics," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.

183. M. Vikram and **B. Shanker**, "Fast evaluation of time domain fields in subwavelength source/observer distributions using accelerated cartesian harmonics," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
184. M. Vikram and **B. Shanker**, "Rapid evaluation of diffusion kernels," USNC/URSI National Radio Science Meeting, Ottawa, July 22-26, 2007.
185. M. Vikram, **B. Shanker**, L. Udpa and S. S. Udpa, "Eddy Current Simulation of Defects in Layered Media Using Discrete Complex Image Method," USNC/URSI Meeting, Ottawa, July 22-26, 2007.
186. J. Gao and **B. Shanker**, "Transient Response from a Periodic Dipole Array over Layered Media," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
187. J. M Villa-Giron, L. Kempel, and **B. Shanker**, "Asymptotic Near-to-Far-Zone Transformation for Conformal Antennas Embedded in an Elliptic Cylinder," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
188. D. Killips, L. Kempel and **B. Shanker**, "Analysis of Radiation and Surface Wave Modes of a Layered Dielectric Rod," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
189. H. Huang, C. Lu and **B. Shanker**, "Cartesian harmonics and fast computation of potentials of form R^{ν} ," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
190. C. Lu, **B. Shanker**, and E. Michielssen, "Development of Time Domain Generalized Finite Element Method for Vector Electromagnetic Problems," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
191. C. Lu and **B. Shanker**, "Development of Generalized Finite Element Method for Vector Electromagnetic Problems," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
192. H. Huang and **B. Shanker**, "Maxwell Cartesian Harmonics and the Static Fast Multipole Method," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
193. J. Gao and **B. Shanker**, "Causality trick and the analytical signal formulation of the time domain periodic Green's function," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006; **Best Student paper finalist**.
194. C. Lu, J. Villa, **B. Shanker**, and L. C. Kempel, "Generalized finite element method for analyzing scattering from non-Lipschitzian domains," 2006 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Albuquerque, July 9-14, 2006.
195. C. Lu and **B. Shanker**, "Solving Boundary Value Problems Using the Generalized (Partition of Unity) Finite Element Method," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005

196. C. Lu and **B. Shanker**, "Development of Hybrid Boundary Integral-Generalized (Partition of Unity) Finite Element Solvers for Scalar Problems," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
197. J. Gao and **B. Shanker**, "Transient Fields Radiated by a Periodic Dipole Array over a Halfspace," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
198. C. Lu and **B. Shanker**, "Towards the Development of Vector Generalized (Partition of Unity) Finite Element Method," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
199. J. Yuan and **B. Shanker**, "Analysis of the Spectrum of the Single Integral Equation for Scattering from Dielectric Objects," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
200. M. Lu, **B. Shanker** and E. Michielssen, "On Uniform Versus Non-Uniform Sampling of Far-Field Patterns in the Plane Wave Time Domain Algorithm," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
201. M. Lu, G. Kobidze, A. Yilmaz, **B. Shanker**, E. Michielssen, "Development of Parallel Higher Order Time Domain Integral Equation Solvers," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
202. G. Kobidze, J. Gao, **B. Shanker**, D. P. Nyquist, "Overcoming the Difficulties in Numerical Analysis of Surface Plasmon Polaritons on Noble Metals at Nanometer Wavelengths," 2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, Washington, DC, July 3-8, 2005
203. N-W. Chen, M. Lu, P. Jiang, F. Capolino, **B. Shanker** and E. Michielssen, "A time-marching scheme for analyzing transient scattering from nonplanar doubly periodic structures," 2004. *IEEE Antennas and Propagation Society Symposium*, **4**, 4535 - 4538, 2004.
204. N. Liu, M. Lu, **B. Shanker** and E. Michielssen, "The parallel plane wave time domain algorithm-accelerated marching on in time solvers for large-scale electromagnetic scattering problems," 2004. *IEEE Antennas and Propagation Society Symposium*, **4**, 4212 - 4215, 2004.
205. G. Kobidze, K. Aygün, and **B. Shanker**, "Efficient integral equation based analysis of scattering from PEC-anisotropic bodies," 2004. *IEEE Antennas and Propagation Society Symposium*, **4**, 3887 - 3890, 2004.
206. C. Trampel, G. Kobidze, **B. Shanker**, and D. P. Nyquist, "A novel algorithm for analysis of surface plasmon polaritons in metallic thin films," 2004. *IEEE Antennas and Propagation Society Symposium*, **3**, 3159 - 3162, 2004.
207. C. Lu, **B. Shanker** and L. C. Kempel, "Partition of unity methods in electromagnetics," *Proceedings of the 2004 URSI International Symposium of Electromagnetic Theory*, 331, 2004.
208. J. Yuan, **B. Shanker**, and L. C. Kempel, "Fast multipole augmented analysis of scattering from dielectric objects using the single integral equation," *Proceedings of the Applied Computational Electromagnetics Society*, 2004.

209. L. Kempel, M. Havrilla, **B. Shanker**, and S. Schneider, "Calibrated modeling of material measurements," *Proceedings of the Applied Computational Electromagnetics Society*, 2004.
210. E. Michielssen, M. Lu and **B. Shanker**, "Fast Time Domain Integral Equation Solvers," SIAM Workshop on Computational Electromagnetism, 2004.
211. Z. Zeng, **B. Shanker** and L. Udpa, Modeling Microwave NDE Using the Element-Free Galerkin Method, Electromagnetic Nondestructive Evaluation (VII), F. Kojima et al (Eds.), IOS Press, , E. Lansing, MI, June 1-2, 2004
212. L. Xuan, **B. Shanker**, Z. Zeng, and L. Udpa, "Element-Free Galerkin Method in Pulsed Eddy Currents," ISEM 2003, Versailles, France, May 2003.
213. G. Kobidze, and **B. Shanker**, "Integral Equation Based Analysis of Scattering from 3-D Inhomogeneous Anisotropic Bodies," Proceedings of the IEEE Antennas and Propagation Symposium, 2003.
214. G. Kobidze, **B. Shanker**, and E. Michielssen, "Hybrid PO-PWTD Scheme for Analyzing of Scattering from Electrically Large PEC Objects," Proceeding of the IEEE Antennas and Propagation Symposium, 2003.
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Technical Reports

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11. V. Jandhyala, E. Michielssen, **B. Shanker**, and W. C. Chew, “A combined steepest descent-fast multipole algorithm for the analysis of three-dimensional scattering by rough surfaces,” CCEM Tech. Report no. 3, 1997.
12. **B. Shanker**, E. Michielssen, and W. C. Chew, “Oblique scattering from an inhomogeneous chiral cylindrical object using axial Beltrami fields and the fast multipole method,” CCEM Tech. Report no. 19, 1996.

VII. Technical Presentations

Invited Presentations

(Several others appear in Section VI)

1. **B. Shanker**, "Novel computational tools for high fidelity electromagnetic simulation," IIT Madras, Chennai, 2018.
2. Connor Glosser, Carlo Piermarocci and **B. Shanker**, "Optically-Active Media: A Microscopic Formulation of the Maxwell-Bloch Equations," Workshop on Bridging the Worlds of Electromagnetic and Quantum Simulations, CECAM, Tel Aviv, Israel, July 2017.
3. **B. Shanker**, "Computational Electromagnetics: Challenges and Opportunities," IIT Madras, India, January, 2017.
4. **B. Shanker**, "Electromagnetics on subdivision surfaces: A novel computational paradigm," Workshop on Electromagnetic theory, UIUC-Zhejiang, May, 2017.
5. **B. Shanker**, "Computational Electromagnetics: Challenges and Opportunities," University of Houston, March, 2017.
6. **B. Shanker**, "Electromagnetics on Subdivision Surfaces: A New Computational Paradigm," Keynote address, Workshop on Computational Electromagnetics, Chendu, China, 2017.
7. **B. Shanker**, "Electromagnetics on subdivision surfaces," Keynote address, Workshop on Computational Electromagnetics, Chendu, China, 2015.
8. **B. Shanker**, "Electromagnetics on subdivision surfaces," Michigan Institute for Computational Discovery and Engineering, University of Michigan, April 8, 2015.
9. **B. Shanker**, "Challenges in modeling wideband-electromagnetic scattering from electrically large densely discretized objects," Pennsylvania State University, State College, PA, Sept 10, 2014.
10. **B. Shanker**, "Challenges in electromagnetic modeling of large multiscale devices/objects," Keynote address, Workshop on Computational Electromagnetics, Chendu, China, 2013.
11. **B. Shanker**, "GMM: A flexible framework for including multiple approximation functions in integral equation solvers," Workshop on Computational Electromagnetics, Chendu, China, 2013.
12. **B. Shanker**, "Overcoming challenges in electromagnetic modeling of electromagnetic fields from large multiscale objects," Purdue University, Oct. 2013.
13. **B. Shanker**, "Challenges in electromagnetic modeling of large multiscale devices/objects," Zhejiang University, Hangzhou, China, 2013.
14. **B. Shanker**, "Challenges in electromagnetic modeling of large multiscale devices/objects," University of Rome, June, 2012.
15. **B. Shanker**, "Challenges in electromagnetic modeling of large multiscale devices/objects," University of California, San Diego, March, 2012.

16. **B. Shanker**, "Generalized Method of Moments: A novel adaptive framework for analyzing scattering from complex objects," Sackler Lecture, Tel Aviv University, November, 2011.
17. **B. Shanker**, "Generalized Method of Moments: A novel adaptive framework for analyzing scattering from complex objects," University of Houston, October, 2011.
18. **B. Shanker**, "Generalized Method of Moments: A novel adaptive framework for analyzing scattering from complex objects," University of Illinois at Urbana, September, 2011.
19. **B. Shanker**, "Steps towards modeling (ultra) wideband-electromagnetic scattering from electrically large, densely discretized objects," University of Texas at Austin, March 2011.
20. **B. Shanker**, "Provably scalable and load-balanced (Ultra)-Wideband Parallel fast multipole method," IEEE Dallas Chapter, 2009.
21. **B. Shanker**, " $\mathcal{O}(N)$ methods for rapidly computing pairwise potentials in large system," Department of Mathematics, University of North Carolina, March, 2008.
22. **B. Shanker**, "Accelerated Cartesian Expansion: An Method for Rapidly Computing Non-Oscillatory Potentials," Dept. Physics and Astronomy, Michigan State University, October, 2007
23. **B. Shanker**, "Accelerated Cartesian Expansion: An Method for Rapidly Computing Non-Oscillatory Potentials," Dept. ECE, University of Illinois at Urbana, February, 2007
24. **B. Shanker**, "An $\mathcal{O}(N)$ algorithm for computing potentials of the form R'' ," University of Michigan, Dec. 2006.
25. **B. Shanker**, "A fast algorithm for computing non-oscillatory potentials," April 2006, University of Delaware.
26. **B. Shanker**, "Development and application of fast and accurate solvers for Maxwell's equations," Applied Mathematics Group, Michigan State University, 2005.
27. **B. Shanker**, "Development and application of fast and accurate solvers for Maxwell's equations," Dept. of Mathematics, Air Force Institute of Technology, March 2005.
28. **B. Shanker**, "Fast solvers for transient electromagnetic simulation," Applied Math Group, MSU, 2003.
29. **B. Shanker**, "Novel fast transient scattering analysis methods," Power Engineering Seminar Series, Iowa State University, 2001.
30. **B. Shanker**, "Fast methods for transient electromagnetic scattering analysis," Dept. Mathematics Colloquium, Iowa State University, 2000.
31. **B. Shanker**, "Computationally efficient methods for scattering analysis," Center for Nondestructive Evaluation Colloquium, 1999.
32. E. Michielssen, A. Ergin, **B. Shanker**, and D.S. Weile, "The Multilevel Plane Wave Time Domain Algorithm and its Applications to the Rapid Solution of Electromagnetic Scattering Problems: a Review," *Proceedings of WAVES2000*, Santiago de Compostella, Spain, July 2000.

33. K. Aygün, **B. Shanker**, A. A. Ergin, and E. Michielssen, "Analysis of Shielding Enclosures Using the Multilevel Plane Wave Time Domain Algorithm," IEEE-EMCC, Seattle, August, 1999.
34. W. C. Chew, J.M. Song, **B. Shanker**, S. Velamparambil, J.S. Zhao, A. Ergin, B. Hu, E. Michielssen, and J.M. Jin, "Fast solvers for integral equations," XXVIth URSI-General Assembly, Toronto, Canada, August 1999.
35. **B. Shanker**, A. A. Ergin and E. Michielssen, "Fast analysis of transient scattering from dielectric bodies using the multilevel plane wave time domain algorithm," XXVIth URSI-General Assembly, 1999.
36. **B. Shanker**, A. A. Ergin and E. Michielssen, "Fast global boundary conditions for 3D FDTD simulations using the plane wave time domain algorithm," XXVIth URSI-General Assembly, August 1999.
37. W. C. Chew, V. Jandhyala, C.C. Lu, E. Michielssen, **B. Shanker**, J.M. Song, and J.S. Zhao, "Fast multilevel techniques for solving integral equations in electromagnetics," 1997 Asia Pacific Microwave Conference, Hong Kong, Dec, 1997.
38. W. C. Chew, V. Jandhyala, C.C. Lu, E. Michielssen, **B. Shanker**, J.M. Song, and J.S. Zhao, "Fast methods for solving electromagnetic scattering problems," International Conference on Electromagnetics in Advanced Applications, Torino, Italy, September, 1997.
39. V. Jandhyala, **B. Shanker**, E. Michielssen, and W. C. Chew, "A combined steepest descent-fast multipole algorithm for the analysis of three-dimensional scattering by rough surfaces," *Invited Talk*, PIERS, April, 1997.
40. **B. Shanker**, E. Michielssen and W. C. Chew, "Oblique scattering from chiral composites using the fast multipole method and Beltrami fields," *Invited Talk*, Applied Computational Electromagnetics Society, March, 1997.
41. **B. Shanker**, "Electromagnetic scattering for a bianisotropic object immersed in a biisotropic medium using Beltrami fields," Invited Seminar, University of Illinois, Urbana-Champaign, Feb., 1996.
42. **B. Shanker**, "Molecular models to predict optical properties of materials," *Invited Seminar*, Pennsylvania State University, Sept., 1994.

Conference Presentations

1. J. Yuan, M. Lu, **B. Shanker**, and E. Michielssen, "Analysis of Transient Scattering from Multiregion Bodies Using a Closed Form Evaluation of Time Domain Fields and the PWTD algorithm," IEEE APS/URSI Symposium, Monterey CA, 2004.
2. G. Kobidze, **B. Shanker** and E. Michielssen, "Hybrid PO -PWTD Scheme for Analyzing Scattering from Deep Cavities," IEEE APS/URSI Symposium, Monterey CA, 2004.
3. C. Lu, J. Yuan, and **B. Shanker**, "Analysis of Scattering from Dielectric Bodies Using the Single Integral and the Nystrom Method," IEEE APS/URSI Symposium, Monterey CA, 2004.

4. C. Trampel, G. Kobidze, and **B. Shanker**, "An Integral Equation Based Algorithm for Analysis of Surface Plasmon Polaritons," IEEE APS/URSI, Columbus, 2003.
5. J. Gao, **B. Shanker**, D. S. Weile, and E. Michielssen, "Analysis of Transient Scattering from Multiregion Bodies Using the Plane Wave Time Domain Algorithm," IEEE APS/URSI, Columbus, 2003.
6. Z. Zeng, L. Xuan, **B. Shanker**, L. Udpa, and L. Kempel, "Element-Free Galerkin Method for Solving Wave Equations," IEEE APS/URSI, Columbus, 2003.
7. **B. Shanker**, K. Aygün and E. Michielssen, "A novel approach to the fast analysis of transient scattering from inhomogeneous dielectric bodies," URSI, Maastricht, 2002.
8. S. Li, A. Boag, **B. Shanker** and E. Michielssen, "Optimally windowed quasi-planar plane wave time domain kernels," IEEE APS/URSI, San Antonio, 2002.
9. K. Yegin, **B. Shanker**, and E. Michielssen, "Fast FDTD boundary kernels for dissipative media," URSI Commission B 2001 Symposium on EM Theory, Vancouver, Canada.
10. K. Aygün, **B. Shanker**, and E. Michielssen, "Fast transient analysis of PCB based devices," in Workshop on Time Domain Methods in Computational Electromagnetics.
11. K. Yegin, **B. Shanker**, and E. Michielssen, "Construction of fast 3D FDTD boundary kernels using a 1D spectral scheme," IEEE APS/URSI Symposium, Boston, 2001.
12. E. Michielssen, K. Aygün, M. Lu, K. Yegin, **B. Shanker** and D. S. Weile, "Fast time domain integral equation solvers: Trends and challenges," IEEE APS/URSI Symposium, Boston, 2001.
13. Y. Li, G. Liu, **B. Shanker**, Y. Sun, P. Sacks, L. Udpa, and S. Udpa, "Solution of 3D inverse problems in eddy current NDE applications," PIERS 2000, Cambridge, MA., 2000.
14. **B. Shanker**, A. A. Ergin, and E. Michielssen, "Analysis of transient scattering from multiregion bodies using the plane wave time domain algorithm," IEEE/URSI Symposium, Salt Lake City, Utah, 2000.
15. **B. Shanker**, A. A. Ergin, and E. Michielssen, "Analysis of transient scattering from rough surfaces using the plane wave time domain algorithm," PIERS, Boston, 2000.
16. **B. Shanker** and A. Lakhtakia, "Homogenization theories for chiral composites," Joint ASME/AES/ Symposium, Evanston, June, 1997.
17. **B. Shanker**, "The use of the Atom-Monopole-Dipole model to predicting optical properties of conjugated polymers," Seminar, University of Illinois, Urbana-Champaign, Dec., 1996.
18. **B. Shanker** and A. Lakhtakia, "Scattering algorithms for Beltrami fields," *Eleventh Army Conference on Applied Mathematics and Computing*, CMU, June, 1993.
19. **B. Shanker** and B. A. Shaw, "Towards the prevention of biofilm growth," *NACE*, Nashville, May, 1992.
20. **B. Shanker**, V. V. Varadan and V. K. Varadan, "Use of shear mode waves for anti-fouling," *Acoustical Society of America*, Baltimore, May, 1991.

21. V. V. Varadan, Y. R. Roh, **B. Shanker**, and V. K. Varadan, "Measurement of the skin friction associated with turbulent flows in air and water using SAW devices," *Proc. IEEE Ultrasonics Symp.*, **1**, 303, 1990.
22. R. YongRae, **B. Shanker**, V. V. Varadan and V. K. Varadan, "Surface acoustic devices for the measurement of wall shear stress," *Acoustical Society of America*, Pennsylvania State University, May, 1990.

VIII. University Service Activities

VIII.1. Description of Some Service Activities at MSU

This is a partial listing of activities that I have initiated/been involved with that have stepped outside boundaries of defined responsibilities (committee or otherwise)

1. Faculty member: I have been asked to undertake numerous tasks (and have done so willingly). By and large, these tasks have been to benefit the college/department at large. Some instances of these are as follows:
 - (a) I developed a template for dual major programs with ECE and established a successful dual major program with Physics. This activity formed the basis of work that I did in CMSE in establishing the rubrics for a number of dual majors between departments
 - (b) I helped extensively (together with Manooch Koochesfahani) in developing the template that the CoE uses for developing dual-degree programs. This involved not just forming the template, but also working with the Graduate school at MSU as well as getting partners on-board at the Indian Institute of Technology. I have expended significant effort the developing the latter in trying establish collaborations across different departments in the College.
 - (c) At the behest of the Dean and Chair of ECE in 2017, I initiated a similar effort to establish a similar program with Tel Aviv University. We have made significant progress making that happen, both in terms of establishing collaborations and contacts at TAU as well working with TAU colleagues to establish rubrics of a dual degree that would be acceptable both. This has almost been completed.
2. Associate Chair for Research ECE My mission in this position was to effectively inculcate a culture of collaboration. To this end, I have leveraged my experiments CMSE and tried to implement some of the same ideas in ECE, with some success. Things that I have instituted are
 - (a) Established an active *ad-hoc* research committee who the Associate Chair reports to, and solicits ideas from, to accomplish the goals
 - (b) To help with any proposal, we have established ideas for red-teaming. Several young faculty are helping and soliciting advise from the team
 - (c) Regularly invite PM to discuss their portfolios
 - (d) Pitched novel ideas to the Air Force; we have identified 5-6 ideas and teams who would bring new ideas. The plan was to expose faculty to potential funding opportunities as well as train them on how to pitch ideas successfully

3. Associate Chair for CMSE This position emanated from starting a new program in both CNS and EGR. Over the past year, thanks to this position, I have had an oversized influence on almost every decision, be it hiring faculty members, creating bylaws, helping create a graduate program, setting up admission requirements and evaluation for graduate students, developing guidelines for Tenure and Promotion (both within the Department and reconciling different expectations between CNS & COE), helping with the CMSE workshop, setting up guidelines/templates for faculty searches and so on. The list is somewhat endless. *But three accomplishments that I am proud of are the intangibles:*

- (a) Active mentoring program that we have established
- (b) Culture of collaboration amongst faculty members
- (c) Culture of faculty governance

It is my firm belief that if this culture is re-enforced, then we will become a collective (as opposed to a collection) and will be successful in the long run. In all of these, I have led by example. I hope to continue to developing such ideas so as to solidify the successful trajectory of CMSE.

4. Associate Chair for Graduate Studies: This position has seen a systematic house-cleaning to get the Department in-line with the College and Graduate school requirements. Aside house-cleaning, the improvements I have initiated are as follows:

- (a) System for awareness of responsibilities of both the student and the advisor
- (b) System for enforcement of Department/College/University requirements (RCR, and so on)
- (c) Promotion of student achievement (best paper awards, fellowships, etc) on a regular basis
- (d) Online Ph.D student reporting system that helps glean data for promotion of students, their research, etc.
- (e) Annual release of Graduate Student Achievements for the preceding year (publications and awards)
- (f) Database development for systematically improving the management of 250+ students in ECE
- (g) Developing the framework for Joint Degree Programs in general and a dual degree program with IIT-Madras (India) and Tel Aviv University

Several of my initiatives in ECE have been adopted by the COE for management of students.

5. Chair: College Strategic Planning Committee: I played a significant role in organizing, coordinating, participating, steering discussion (at times), and finally compiling the document. I presented this to the faculty and it was formally adopted.
6. Chair: Engineering College Advisory Committee: I served as the Chair of ECAC. While several things were accomplished by this body, the specific projects that I initiated and undertook were the following:
- (a) a detailed step by step mentoring policy for faculty members of promotable rank
 - (b) developed a teaching effectiveness guideline for the college together with Rick Lyles and others
 - (c) organized and ran the College strategic planning committee

- (d) played a key role in designing FAIS including basic design, test driving, feedback and suggestions to improve
 - (e) together with DECS instituted online voting for University committees
7. Chair: ECE Department Strategic Planning Committee: This followed my stint at the college, and again I organized a collective effort to tailor the Departmental needs with that of the College.

University Committees

1. ISU Graduate Council; 2000-2002
 - (a) Chair, English language assessment sub-committee
 - (b) Chair, TA training sub-committee
2. MSU University Graduate Council; 2004-2006
3. Member-High Performance Computing Committee, 2008-2009.
4. Leadership team for high performance computing institute, 2008-2009
5. IRGP Panelist; 2005-2007
6. Steering committee; Institute for Computation Enabled Research, 2009-2013
7. Joint Degree Committee: 2013-present
8. Advisory Committee for CGA: 2014-present
9. University Fellowship committee; 2014-2016

MSU College Committees

1. Engineering Research and Graduate Studies Committee (ERGSC); 2004-2006
2. Library Committee; 2002-2015
3. Math Liaison Committee; 2002-present
4. College of Natural Science, Faculty Advisory Committee; 2016-2018
5. College of Natural Science; FAC-subcommittee–Teaching effectiveness; 2016-2018
6. Engineering College Advisory Committee; 2006-2010; 2016-2018
7. College of Engineering, Promotion and Tenure Committee; 2010-2018; 2019-
 - (a) Chair; 2007-2008
 - (b) Chair; 2009-2010
8. Chair: Ad-hoc Strategic Planning committee, 2008-2009
9. Member: Ad-hoc Committee on Teaching Effectiveness, 2008-2009

10. Member: Ad-hoc Committee on Implementing Teaching Related Recommendations; 2009-2010
11. Member: Promotion and Tenure Committee, 2010-present
12. Graduate Directors Ad-hoc committee; 2013-2015 (ECE)
13. Graduate Directors Ad-hoc committee; 2015-2018 (CMSE)

Departmental Committees

1. Curriculum Committee (ISU), 1999-2002
2. Chair; Awards Committee (MSU), 2004-2009, 2014-2015
3. Graduate Committee (MSU), 2002-2004, 2005-current; Chair 2008-2011
4. Chair; Ad-hoc ECE Strategic Planning Committee; 2008-2009
5. Faculty Mentor; Connector Faculty, 2009-current
6. Ad-hoc, ECE Program Review Committee; 2009-2010
7. Advisory Committee, 2007-2009, 2010-2012
8. Promotion and Tenure Committee; 2009-2010 (Chair: 2010)
9. Electrosience Group (ECE): 2014-current (Chair)
10. Accelerator Technology Hiring Committee (ECE): 2015-current
11. Electromagnetics Hiring Committee (ECE): 2015-current
12. Data Science Hiring Committee (CMSE); 2015-current
13. Scientific Computing Hiring Committee (CMSE); 2015-current
14. Lattice QCD Hiring Committee (CMSE); 2015-2016
15. Graduate Admissions Committee (CMSE): 2015-current
16. Advisory Committee (CMSE): 2015-present
17. Graduate Handbook (CMSE): 2015-2016
18. Graduate Recruiting Committee (CMSE): 2015-present

Other

1. Faculty Advisor; MSU Eta Kappa Nu (2003-2009)

IX. Professional Service Activities

Member of

1. Institution of Electrical and Electronic Engineers (Grade: Fellow)
 - (a) IEEE Antennas and Propagation
 - (b) IEEE Microwave Theory and Techniques
 - (c) Chair; Membership Committee for IEEE Antennas and Propagation Society (2002-2010)
 - (d) Membership Committee for IEEE Antennas and Propagation Society, 2010-present
 - (e) IEEE Fellows Committee, IEEE AP Society 2013-2016
2. Optical Society of America
3. Applied Computational Electromagnetic Society
4. Eta Kappa Nu

Editorship in Journals

1. Associate Editor, IEEE Transactions on Antennas and Propagation, 2010-2016
2. Topical Editor, Journal of Optical Society of America, A, 2015-present
3. Associate Editor, IEEE Antennas and Propagation Wave Letters (2001-2007)

Other

1. Organized CECAM workshop on Bridging the Worlds of Electromagnetic and Quantum Simulations, 2017 (in Israel)
2. IEEE APS 2019 Technical Program Co-Chair
3. IEEE APS, Best Paper Award Committee, 2014-2018; Chair (2015)-2018
4. IEEE APS, 2016 & 2017, Computational EM Topic Program Chair
5. Steering Committee: FEM2014, FEM2016
6. Special session organizer, FEM2010, FEM2012, ICEAA2012, FEM2014, ICEAA2014
7. Session Chair (Multiple sessions), IEEE Antennas and Propagation symposium, *every year since 1997*
8. Committee for special sessions, URSI (2008-)
9. Antennas and Propagation Membership Chair, 2002-2012
10. Technical Program Committee/organizer, Workshop on Finite Element Methods, 2010.
11. Organizing Committee, EIT, 2006.

12. Session Organizer: IEEE-APS, 2010
13. Session Organizer: PIERS 2000, Boston, USA.
14. Session Organizer: ACES 2001, Monterey, CA, USA
15. Session Organizer: ACES 2009, Monterey, CA, USA
16. Technical Program Committee, IEEE APS, 2001, 2002, 2003
17. Exhibits Chair, ACES, 2002

X. Extension and Outreach Activities

1. Taught Video Taped Course: EE 512 (Advanced Electromagnetics for Engineers I)
2. Taught Video Taped Course: EE 513 (Advanced Electromagnetics for Engineers II)

XI. Students

XI.1. PhD Students who have won Nationally Competitive Fellows under my tutelage

1. A. D. Baczewski (NSF Fellow)
2. A. Pray (SMART Fellow)
3. D. Dault (NDSEG Fellow & NSF Fellow)
4. N. Miller (SMART Fellow)
5. S. O'Connor (SMART Fellow)
6. Z. Crawford (DOE-CSGF, SMART, NDSEG Fellow)

XI.2. Undergraduate Students

1. Christopher Trampel, 2001-2002
2. Norman Anderson, 2001-2002
3. Abhishek Chandra, 2003Su
4. Andrew Temme, 2008Su
5. Eric Myers, 2008Su
6. Casey Davidson, 2009Su
7. Cody Knowles, 2009Su-2009F
8. Andrew Pray, 2010F

9. Dan Dault, 2009F-2010S
10. Nick Miller, 2011Su-2013Summer
11. John Demry, 2011Su-2012F
12. Osama E, 2011F
13. Marco Santia, 2013S-2013Summer
14. Zane Crawford, 2013F-2015Su
15. Alex Chamberly, 2014-2015Sp
16. Bailey Winters, 2014-2015Sp
17. Michael Straub, 2016Su-2016F
18. Brendon Johns, 2016Su
19. Abdel Alsnayyan, 2016F-2017Su
20. Jack Hammel, 2016F-2019
21. Thomas Bertus, 2019-
22. Chad Moorman, 2019

Current Graduate Student

1. Scott O'Connor (Ph.D, expected 2021)
2. Zane Crawford (Ph.D, expected 2021)
3. Luke Baumann (Ph.D, expected 2022)
4. Abdel Alsnayyan (Ph.D, expected 2022)
5. Omkar Ramachandran (Ph.D, expected 2023)
6. Elliot Lu (Ph.D, expected 2023)
7. Jacob Hawkins (Ph.D, expected 2024)
8. Ian Neuhart, (Ph.D., expected 2025)
9. Chad Moorman, (Ph.D., expected 2025)

Masters Degree Thesis

1. T. Zheng, "Towards determining the dielectric properties of a body using scattered field measurement," M. S., Aug. 2000.
2. S. Balasubramanian, "A Fast Integral Equation Based Scheme For Computing Magneto-Static Fields in Nonlinear Media," M.S., Aug. 2001
3. K. N. Pratima, "Towards the design of tunable photonic waveguides," M.S., Aug. 2002
4. K. Webb, "Comparing emission measurements in a reverberation chamber and a semi-anechoic chamber," M.S., Aug. 2002.
5. L. N. Subramaniam, "A technique for well conditioning of systems resulting from tree/cotree decomposition," M.S., May 2003.
6. C. Trampel, "Periodic layered medium Green's function for analyzing surface plasmon polaritons," M.S. 2004
7. J. Yuan, "Spectral properties of the single integral equation", M.S. 2005.

Post Doctoral Research Associates

1. Gregory Kobidze, 2001-2005
2. Liang Xuan, 2001-2003
3. Zheiwai Zheng, 2002-2003
4. M. Vikram, 2009-2010
5. N. Nair, 2010-2012

Ph. D Dissertation

1. L. Xuan, "A meshless element free Galerkin method for NDE analysis," Ph. D, Aug. 2002.
2. J. Gao, "Analytic signal and causality trick to evaluate radiation from a periodic array over a half-space," Ph. D, Aug. 2006.
3. C. Lu, "Development of vector generalized finite element methods and application to electromagnetics, Ph.D, Sept. 2007.
4. Jorge Villa-Giron, "Development of methods for conformal antennas," May 2008.
5. M. Vikram, "Fast Computational Techniques for Multiscale Electromagnetic Simulations," May 2009.
6. N. V. Nair, "Development of the Generalized Method of Moments: A novel discretization scheme for integral equations," May 2010
7. H. Huang, "Studies of charge neutral FCC lattices with Yukawa interaction model and the accelerated Cartesian method," Dec 2011. (Ph.D in Physics)

8. O. Tüncer, "Development and applications of vector generalized finite element method in electromagnetics," July 2012.
9. A. D. Bacewski, "Integral equation and discontinuous Galerkin methods for light matter interaction," March 2013 (Ph.D ECE and Physics)
10. C. S. Meierbachtol, "Modeling of Hydrogen-Based Plasmas in Microwave Plasma-Assisted Chemical Vapor Deposition Reactors at Moderate Pressures," July 2013.
11. A. J. Pray, "A robust stabilization methodology for time domain integral equations in electromagnetics," July 2014
12. D. Dault, "The generalized method of moments for electromagnetic integral equations: New formulations and applications," March 2015.
13. Jie Li, "Integral Equations in Computational Electromagnetics : formulations, Properties and Isogeometric Analysis," 2018.
14. Stephen Hughey, "Efficient Parallelization of Non-uniform Fast Multipole Algorithms," 2018.
15. Connor Glosser, "The Quest for Active Media Models : a Self-Consistent Framework for Simulating Wave Propagation in Nonlinear Systems," 2018.
16. Mike Lingg, "Novel Parallel Algorithms and Performance Optimization Techniques for the Multi-Level Fast Multipole Algorithm," 2020 (co advised with Metin Aktulga)
17. S. O'Connor, "Methods to Ensure Satisfaction of Charge Conservation for Finite Element Particle-In-Cell Methods," 2021.

XII. Additional Information

Reviewer for:

- US Civilian Research and Development Foundation
- NSF
- IEEE Trans. Antennas and Propagat.
- IEEE Trans. Magnetics
- IEEE Trans. MTT
- IEE Proceedings H
- Microwave and Optical Tech. Lett.
- Radio Science
- J. Opt. Soc. Am. A
- International Journal of Applied Electromagnetics & Materials
- Optics Letters
- Journal of Computational Physics
- Electronics Letters
- Wave Motion