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Curriculum Vitae --Dezhi WANG

EDUCATION

Aug. 2015 – Dec. 2020	**Duke University**	**Ph.D.** in Electrical and Computer Engineering
Advisor: Qing Huo Liu		*Durham, NC, USA*
Sept. 2012- June 2015	**Jilin University**	**M. Eng.** in Applied Geophysics
Advisor: Changchun Yin		*Changchun, Jilin, China*
Sept. 2008- June 2012	**Jilin University**	**B. Eng.** in Applied Geophysics

ACADEMIC APPOINTMENTS

Mar. 2021 – Present	**Purdue University**	**Post Doctoral Associate**
Advisor: Luis Javier Gomez & Weng Cho Chew		*West Lafayette, IN, USA*
Sept. 2015 – Dec. 2020	**Duke University**	**Research Assistant**
Advisor: Qing Huo Liu		*Durham, NC, USA*
Sept. 2013 – June 2025	**Jilin University**	**Research Assistant**
Advisor: Changchun Yin		*Changchun, Jilin, China*

WORK EXPERIENCE

June-Aug. 2018	**Schlumberger-Doll Research Center**	**Internship**
Advisor: Dzevat Omeragic		*Boston, MA, USA*

RESEARCH INTERESTS

- **Electromagnetic (EM) methods for geophysical applications** (such as monitoring of hydraulic fracture networks, mineral detection, geothermal detection, monitoring of CO_2 storage underground, land EM, marine controlled source EM, airborne EM, and well EM etc.);
- **2D/3D EM numerical simulations** (with integral equation/finite element/finite difference/numerical mode matching methods);
- **Inversion theories and applications** (geophysical inversion using EM methods, joint inversion theories and applications, deep learning theories and applications);
- **Green's function theories** (in isotropic and anisotropic layered media);
- **Induced polarization theories** (in marine controlled-source EM and airborne EM);
- **Acoustic/Elastic wave propagation simulations** (using finite difference/pseudo-spectral/k-space/finite element time domain methods with perfectly matched layers as bound);
- **Transcranial brain stimulations** (such as transcranial magnetic stimulation, transcranial electric stimulation, ultrasound brain stimulation);
- **Magneto-acoustic tomography with magnetic induction (MAT-MI).**

INVITED TALKS

- **"Fast 3D Electromagnetic Simulations in Complicated Media",** Department of Electrical and Computer Engineering, University of Houston, Sept. 2023.
- **"3D Electromagnetic Simulations and Inversion in Complicated Media",** Institute of Geology and Geophysics, Chinese Academy of Sciences, Sept. 2023.
- **"3D Electromagnetic Simulations and Inversion in Complicated Media",** College of Geophysics

and Information Technology, China University of Geosciences (Beijing), Sept. 2023.

- **"Fast 3D Electromagnetic Simulations in Complicated Geophysical Applications",** College of Geo-exploration Science and Technology, Jilin University, May 2021.

HONORS & AWARDS

- **National Scholarship for Graduates**, awarded by Ministry of Education, China, in successive three years (2012, 2013, 2014).
- **Outstanding Graduation Thesis of College,** awarded by Jilin University, June 2012.
- **Outstanding Student of College**, awarded by College of Geo-exploration, in successive two years (2010, 2011).
- **National Encouragement Scholarship**, awarded by Ministry of Education, China, in successive three years (2009, 2010, 2011).
- **Outstanding Student of University** (top 5% in university), awarded by Jilin University, Sept. 2009.
- **Second-Class Prize of Student Innovation Program** for Research and Development of Instrument for Electrical Exploration based on Correlation Identification, awarded by Joint Conference of Nation-level Experiment and Teaching Demonstration Center of Higher Education Institutions, June 2011.

PUBLICATIONS

Journal papers and dissertations

[1] **Wang, D.,** Y. Hu, Y. Fang, Y. Mao and Q. H. Liu (2023). Fast 3D Volume Integral Equation Domain Decomposition Method for Electromagnetic Scattering Using Adaptive Cross Approximation. IEEE Transactions on Geoscience and Remote Sensing, 61, pp.1-9.

[2] **Wang, D.,** N. I. Hasan, M. Dannhauer, A. C. Yucel, and L. J. Gomez (2023). Fast Computational E-field Dosimetry for Transcranial Magnetic Stimulation using Adaptive Cross Approximation and Auxiliary Dipole Method (ACA-ADM). NeuroImage, p.119850.

[3] **Wang, D.,** J. Dai, Y. Fang, Y. Hu, Q. Zhan, R. Zhang, W. F. Huang and Q. H. Liu (2022). Simulation of Thin-Layer Sheet Under Cylindrical Geometry Using the Numerical Mode Matching with Surface Current Boundary Condition (NMM-SCBC). IEEE Transactions on Geoscience and Remote Sensing, 60, pp.1-10.

[4] **Wang, D.,** Y. Hu, Y. Fang, Q. Zhan, R. Zhang, W. F. Huang and Q. H. Liu (2019). Fast 3D Volume Integral Equation Domain Decomposition Method for Electromagnetic Scattering by Complex Inhomogeneous Objects Traversing Multiple Layers. IEEE Transactions on Antennas and Propagation, 68(2), 958-966.

[5] **Wang D.** (2020). Forward Modeling and Inversion of 3D Electromagnetic Scattering Problems in Complicated Backgrounds. Duke University: Ph.D. dissertation.

[6] **Wang D.** (2015). Three-dimensional EM Forward Modelling Based on Integral Equation Method. Jilin University: Master dissertation.

[7] **Wang D.,** S. Yan, Z. Dong, X. Tan, Z. Li, Y. Liu (2015). Induced Polarization Effect of Marine CSEM Based on Two Polarization Modes of Oil/Gas Reservoir. Progress in Geophysics, 30 (3), 1304-1314.

[8] Hasan, N., **D. Wang**, and L. Gomez (2023). Fast and Accurate Population Level Transcranial Magnetic Stimulation via Probabilistic Matrix Decomposition. Computers in Biology and Medicine.

[9] Dai J., **Wang, D.,** Y. Fang, and Q. H. Liu (2024). Efficient Computation of Electromagnetic Waves

Due to a Line Current Source Using Spectral Numerical Mode Matching (SNMM) Method. IEEE Transactions on Geoscience and Remote Sensing.

[10] Dannhauer M., L. Gomez, P. Robins, **D. Wang**, N. Hasan, A. Thielscher, and Zhi-De Deng (2023). Electric field modeling in personalizing TMS interventions. Biological Psychiatry.

[11] Mao Y., Q. Zhan, Q. Sun, **D. Wang**, Q. H. Liu (2023). Mesh-splitting impedance transition boundary condition for accurate modeling of thin structures. IEEE Transactions on Antennas and Propagation.

[12] Mao Y., Y. Zhong, Q. Zhan, **D. Wang**, Q. H. Liu (2023). A Simple Way of Applying the Calderón Preconditioner to a Finite-Element Boundary-Integral Method. IEEE Transactions on Antennas and Propagation.

[13] Mao Y., Q. Zhan, **D. Wang**, R. Zhang, Q. H. Liu (2021). Modeling Thin 3-D Material Surfaces Using a Spectral-Element Spectral-Integral Method with the Surface Current Boundary Condition. IEEE Transactions on Antennas and Propagation 70 (3), 2375-2380.

[14] Zhang R., Q. Sun, X. Zhang, L. Cui, Z. Wu, K. Chen, **D. Wang**, Q. H. Liu (2020). Imaging hydraulic fractures under energized steel casing by convolutional neural networks. IEEE Transactions on Geoscience and Remote Sensing 58 (12), 8831-8839.

[15] Mao Y., Q. Zhan, R. Zhang, **D. Wang**, W. Huang, Q. H. Liu (2020). Fast simulation of electromagnetic fields in doubly periodic structures with a deep fully convolutional network. IEEE Transactions on Antennas and Propagation 69 (5), 2921-2928.

[16] Huang W., H. Wang, Y. Zhong, R. Zhang, **D. Wang**, Y. Mao, Y. Jia, Q. H. Liu (2020). Surface integral equations for low-frequency simulation in well logging applications. IEEE Transactions on Antennas and Propagation 69 (7), 3957-3965.

[17] Zhang R., Z. Wu, Q. Sun, M. Zhuang, Q. Cai**, D. Wang**, Q. H. Liu (2019). Memory-Efficient 3-D LWD Solver with the Flipped Total Field/Scattered Field-Based DGFD Method. IEEE Geoscience and Remote Sensing Letters.

[18] Hu Y., Y. Fang, **D. Wang,** Q. Zhan, R. Zhang, Q. H. Liu (2019). The Scattering of Electromagnetic Fields from Anisotropic Objects Embedded in Anisotropic Multilayers. IEEE Transactions on Antennas and Propagation, 67 (12), 7561-7568

[19] Huang W. F., H. Wang, Q. Zhan, Y. Fang, **D. Wang**, R. Zhang, Q. H. Liu (2019). Thin Dielectric Sheet-Based Surface Integral Equation for the Scattering Simulation of Fractures in a Layered Medium. IEEE Transactions on Geoscience and Remote Sensing, 57(10), 7606-12.

[20] Zhan Q., M. Zhuang, Y. Fang, Y. Hu, Y. Mao, W. F. Huang, R. Zhang, **D. Wang**, Q. H. Liu (2019). Full-anisotropic poroelastic wave modeling: A discontinuous Galerkin algorithm with a generalized wave impedance. Computer Methods in Applied Mechanics and Engineering, 346, 288-311.

[21] Wang H., W. F. Huang, Y. Fang, R. Zhang, **D. Wang**, Q. Zhan, Q. H. Liu (2019). Efficient and accurate electromagnetic modeling of triaxial induction responses from multiscale fractures for well-logging applications. IEEE Journal on Multiscale and Multiphysics Computational Techniques, 4, 20-28

[22] Zhang R., Q. Sun, M. Zhuang, W. F. Huang, Q. Zhan, **D. Wang**, Q. H. Liu (2018). Optimization of the Periodic PML for SEM. IEEE Transactions on Electromagnetic Compatibility, 61 (5), 1578-1585

[23] Hu Y., Y. Fang, **D. Wang,** Y. Zhong, Q. H. Liu (2018). Electromagnetic waves in multilayered generalized anisotropic media. IEEE Transactions on Geoscience and Remote Sensing, 56(10), 5758-66.

[24] Ahmadian M., D. LaBrecque, Q. H. Liu, W. Slack, R. Brigham, Y. Fang, K. Banks, Y. Hu, **D. Wang**, R. Zhang. Demonstration of proof of concept of electromagnetic geophysical methods for high

resolution illumination of induced fracture networks. In SPE Hydraulic Fracturing Technology Conference and Exhibition 2018 Jan 23. Society of Petroleum Engineers.

[25] Fang Y., Y. Hu, Q. Zhan, **D. Wang,** R. Zhang, Q. H. Liu (2018). A Fast Numerical Method for the Galvanic Measurement in Hydraulic Fracture Detection. IEEE Transactions on Antennas and Propagation, 68 (2), 947-957.

Conference papers and presentations

[1] **D. Wang,** Q. H. Liu, "Fast 3D Electromagnetic Scattering Modeling of Multiscale Problems in a Layered Medium using Integral Equation Method," The International Meeting for Applied Geoscience & Energy (IMAGE), Sept. 2023.

[2] **D. Wang,** Q. H. Liu, "NMM Simulation of Electromagnetic Waves in Cylindrical Geometries with an Extremely Thin Vertical Layer," Antennas and Propagation Society International Symposium (APS/URSI), July 2023.

[3] **D. Wang,** Q. H. Liu, "Fast 3D Volume Integral Equation Domain Decomposition Method for Electromagnetic Scattering Using Adaptive Cross Approximation," Antennas and Propagation Society International Symposium (APS/URSI), July 2023.

[4] **D. Wang,** N. I. Hasan, L. J. Gomez, "Fast E-field Determination of Transcranial Electric Stimulation using Probabilistic Matrix Decomposition," Antennas and Propagation Society International Symposium (APS/URSI), July 2023.

[5] N. I. Hasan, **D. Wang,** L. J. Gomez, "Application of Fast E-Field Solvers in Developing Individualized Optimal Transcranial Magnetic Stimulation and Population-level Uncertainty Quantification," Antennas and Propagation Society International Symposium (APS/URSI), July 2023.

[6] N. I. Hasan, **D. Wang,** L. J. Gomez, "Real Time E-Field Dosimetry Estimation in Transcranial Magnetic Stimulation via Probabilistic Matrix Decomposition (PMD) and Huygens' Principle," Antennas and Propagation Society International Symposium (APS/URSI), July 2023.

[7] **D. Wang,** N. I. Hasan, L. J. Gomez, "Fast Computational Dosimetry of Transcranial Electric Stimulation using Probabilistic Matrix Decomposition," International Applied Computational Electromagnetics Society (ACES) Symposium, Mar 2023.

[8] N. I. Hasan, **D. Wang,** L. J. Gomez, "Fast Solvers for Population-level Optimization and Uncertainty Quantification in Transcranial Magnetic Stimulation (TMS)," Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation, Feb 2023.

[9] **D. Wang,** N. I. Hasan, D. Czerwonky, L. J. Gomez, "Modeling of the Meninges as a Boundary Condition in Computational E-field Dosimetry," Antennas and Propagation Society International Symposium (APS/URSI), July 2022.

[10] **D. Wang,** N. I. Hasan, L. J. Gomez, "Benchmarking Transcranial Magnetic Stimulation (TMS) Coils in Terms of Their Induced E-field in Realistic MRI-derived Head Models," Antennas and Propagation Society International Symposium (APS/URSI), July 2022.

[11] **D. Wang,** N. I. Hasan, L. J. Gomez, "Uncertainty Quantification of TMS Simulations Considering MRI Segmentation Errors," Antennas and Propagation Society International Symposium (APS/URSI), July 2022.

[12] N. I. Hasan, **D. Wang,** L. J. Gomez, "Optimal Population Level Transcranial Magnetic Stimulation via Probabilistic Matrix Decomposition," Antennas and Propagation Society International Symposium (APS/URSI), July 2022.

[13] **D. Wang,** M. Dannhauer, A. C. Yucel, L. J. Gomez, "Adaptive Cross Approximation for E-field Guided Non-invasive Magnetic Brain Stimulation," Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation, Dec 2021.

[14] **D. Wang,** N. I. Hasan, L. J. Gomez, "Fast E-field Simulation in the Transcranial Magnetic Stimulation using Adaptive Cross Approximation," Antennas and Propagation Society International Symposium (APS/URSI), Dec 2021.

[15] N. I. Hasan, **D. Wang,** L. J. Gomez, "Virtual Head Model Embedding for Population-Based Uncertainty Quantification," Antennas and Propagation Society International Symposium (APS/URSI), Dec 2021.

[16] **D. Wang,** M. Dannhauer, A. C. Yucel, L. J. Gomez, "Adaptive Cross Approximation for E-field-guided Noninvasive Magnetic Brain Stimulation," International Applied Computational Electromagnetics Society (ACES) Symposium, Aug 2021.

[17] **D. Wang**, Y. Hu, Y. Fang, Q. Zhan, Q. H. Liu, "Fast 3D Volume Integral Equation Domain Decomposition Method for Electromagnetic Scattering by Complex Inhomogeneous Objects in Multiple Layers," AGU Fall Meeting, Dec 2018.

[18] **D. Wang,** Y. Hu, Y. Fang, W. Huang, R. Zhang, Q. H. Liu, "3D Modeling of Complex Structures with the BCGS-FFT-DDM," Antennas and Propagation Society International Symposium (APS/URSI), July 2018.

[19] W. Huang, Y. Fang, R. Zhang, **D. Wang,** H. Wang, Q. H. Liu, "Thin Dielectric Sheet-based Surface Integral Equation for Simulating the Multiscale Hydraulic Fractures in a Layered Medium," Antennas and Propagation Society International Symposium (APS/URSI), July 2018.

[20] Y. Fang, Y. Hu, **D. Wang,** Q. H. Liu, "Electromagnetic Algorithms for 3D Fracture Evaluation Under Planar Stratified Media in Through-casing Measurement," Antennas and Propagation Society International Symposium (APS/URSI), July 2018.

[21] W. Huang, R. Zhang, **D. Wang,** Y. Fang, H. Wang, Q. H. Liu, "Low-frequency Electromagnetic Simulation of Targets in Layered Media by a Hybrid Solver Based on Finite Element Method and Current and Charge Integral Equation," Antennas and Propagation Society International Symposium (APS/URSI), July 2018.

[22] Y. Fang, Y. Hu, **D. Wang,** Q. H. Liu, "Algorithm and Experimental System for Arbitrary 3D Fracture Network Detection and Mapping in Tri-axial Through-Casing Induction Measurement," Antennas and Propagation Society International Symposium (APS/URSI), July 2017.

[23] Y. Hu, Y. Fang, **D. Wang,** Q. H. Liu, "Hydraulic Fracture Imaging with Galvanic Measurements," Antennas and Propagation Society International Symposium (APS/URSI), July 2017.

Pending papers

[1] **Wang, D.,** Q. H. Liu, and M. Ahmadian. Modeling of Contrast-Agent-Augmented Energy Harvesting in Steel-Cased Borehole Cement. Journal of Environmental and Engineering Geophysics. (Submitted)

[2] **Wang, D.,** Y. Hu, Y. Fang, and Q. H. Liu. Fast 3D Volume Integral Equation Domain Decomposition Method for Electromagnetic Scattering Using Randomized Matrix Decomposition. IEEE Transactions on Geoscience and Remote Sensing. (To be submitted)

[3] **Wang D.**, N. Hasan, and L. Gomez. Fast E-field Evaluation of Transcranial Electric Stimulation Using Probabilistic Matrix Decomposition. IEEE Transactions on Biomedical Engineering. (To be submitted)

[4] **Wang, D.,** Y. Hu, Y. Fang, and Q. H. Liu. Fast 3D Volume Integral Equation Method for Complicated Structures. IEEE Transactions on Geoscience and Remote Sensing. (Under preparation)

[5] **Wang, D.,** Y. Hu, Y. Fang, and Q. H. Liu. 3D Inversion Based on Volume Integral Equation Method Domain Decomposition Method for Complicated Structures. IEEE Transactions on Geoscience and Remote Sensing. (Under preparation)

SERVICES

Professional services

Co-chair of IEEE APS/URSI 2021 Session TH-UK.1A: Electromagnetics in Biology and Medicine I;

Reviewers of several journals, including IEEE Transactions on Geoscience and Remote Sensing, IEEE Geoscience and Remote Sensing Letters, Geophysics, IEEE Access, IEEE Transactions on Antennas and Propagation, etc.

Public services

Purdue Post Doctoral Association

Vice President (Jan. 2023-Present), Member of board committee (Sept 2021-Dec 2022)

Duke Engineering Graduate Student Council

Electrical engineering representative (Sept. 2018- Aug. 2019)

Duke Chinese Students and Scholars Association

Member of administrative/supervision committee (June 2016-May 2020)

Volunteers for Western China Program

Volunteer teacher in an elementary school for immigrants in Ningxia, China (Aug. 2012-July 2013)

PROFESSIONAL SOCIETY MEMBERSHIPS

SEG, AGU, EAGE, IEEE, IEEE AP-S, IEEE GRSS