

# Adam B. Birchfield

Assistant Professor  
Department of Electrical and Computer  
Engineering  
Texas A&M University  
College Station, TX

Office: WEB 215E  
Tel: 979-862-2545  
Email: [abirchfield@tamu.edu](mailto:abirchfield@tamu.edu)

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## *Education*

<b>Texas A&amp;M University</b> Ph.D., Electrical Engineering, Energy and Power Area	College Station, TX Dec. 2018
<b>University of Illinois at Urbana-Champaign</b> M.S., Electrical and Computer Engineering, Energy and Power Area	Urbana, IL Dec. 2016
<b>Auburn University</b> B.E.E., Electrical Engineering, Summa Cum Laude, Honors Scholar	Auburn, AL Dec. 2014

## *Experience*

<b>Texas A&amp;M University</b> Assistant Professor, Electrical and Computer Engineering Graduate Research Assistant, ECEN	College Station, TX Nov. 2020—present Dec. 2016—Dec. 2018
<b>Electric Power Research Institute</b> Engineer/Scientist, Transmission Operations and Planning, Electromagnetic Threats Group	Charlotte, NC Sept. 2019—Nov. 2020
<b>Birchfield Consulting LLC</b> Independent Research Consultant, contracting to Texas A&M University	College Station, TX Dec. 2018—Sept. 2019

<b>University of Illinois at Urbana-Champaign</b> Graduate Research Assistant, Electrical and Computer Engineering	Urbana, IL Aug. 2015—Dec. 2016
<b>Electric Power Research Institute</b> Contract Engineer, Power System Studies Research Group	Knoxville, TN Feb. 2015—Aug. 2015
<b>Alabama Power Company</b> Engineering Summer Intern, APC Transformer and Electrical Shops	Calera, AL May 2014—Aug. 2014
<b>Technische Universität Kaiserslautern</b>  Research Intern, German Academic Exchange Service (DAAD) RISE Program	Kaiserslautern, Germany May 2013—Aug. 2013
<b>Itron, Inc.</b> Student Intern, Research and Development	West Union, SC May 2012—Aug. 2012

## Teaching

### Texas A&M University

- *ICPE 615 Smart Grid Fundamentals*, intensive course December 2022
- *ECEN 460 Power Systems Operation and Control*, Spring 2021, Spring 2023
- *ECEN 616 Electromagnetic Transients in Power Systems*, Fall 2022
- *ECEN 214 Electrical Circuit Theory*, Spring 2022
- Short Course on *Power System Analysis*, for Southwest Power Pool, Oct-Nov 2021
- *ECEN 615 Methods of Large-Scale Electric Grid Analysis*, Fall 2021
- Short course on *Automating PowerWorld with Python*, Nov. 19-22, 2019.
- Graduate Teaching Fellow: *ECEN 460 Power Systems Operation and Control*, Fall 2018 [J8]
- Guest Lecturer, “Synthetic power grids,” in *ECEN 615 Methods of Electric Power System Analysis*, Fall 2018

- Fellow of the Academy for Future Faculty, Center for the Integration of Research, Teaching, and Learning (CIRTL), Apr. 2018
- Teaching Assistant, Guest Lecturer, *ECEN 460 Power Systems Operation and Control*, Fall 2017

## Books

- [B1] J. D. Glover, T. J. Overbye, A. B. Birchfield, and M. S. Sarma, *Power System Analysis and Design*, 7<sup>th</sup> ed. Boston, MA: Cengage, 2023.

## Journal Publications

- [J13] A. B. Birchfield, “Graph decomposition for constructing blackstart restoration strategies in benchmark cases,” *Electric Power Systems Research*, Nov. 2022.
- [J12] H. Li *et al.*, “Building highly detailed synthetic electric grid data sets for combined transmission and distribution systems,” in *IEEE Open Access Journal of Power and Energy*, vol. 7, pp. 478-488, Nov. 2020.
- [J11] A. B. Birchfield and T. J. Overbye, “Mosaic Packing to Visualize Large-Scale Electric Grid Data,” in *IEEE Open Access Journal of Power and Energy*, vol. 7, pp. 212-221, Jun. 2020.
- [J10] C. Coffrin, et al., “The power grid library for benchmarking ac optimal power flow algorithms,” Pre-print available: <https://arxiv.org/pdf/1908.02788.pdf>, Aug. 2019.
- [J9] R. H. Lee, K. S. Shetye, A. B. Birchfield, and T. J. Overbye, “Using detailed ground modeling to evaluate electric grid impacts of late-time high-altitude electromagnetic pulses (E3 HEMP),” *IEEE Transactions on Power Systems*, vol. 34, no. 2, pp. 1549-1557, Mar. 2019.
- [J8] A. B. Birchfield, T. J. Overbye, and K. R. Davis, “Educational applications of large synthetic power grids,” *IEEE Transactions on Power Systems*, vol. 34, no. 1, pp. 765-772, Jan. 2019.
- [J7] A. B. Birchfield and T. J. Overbye, “Techniques for drawing geographic one-line diagrams: Substation spacing and line routing,” *IEEE Transactions on Power Systems*, vol. 33, no. 6, pp. 7269-7276, Nov. 2018.
- [J6] A. B. Birchfield, T. Xu, and T. J. Overbye, “Power flow convergence and reactive power planning in the creation of large synthetic

grids,” *IEEE Transactions on Power Systems*, vol. 33, no. 6, pp. 6667-6674, Nov. 2018.

- [J5] T. Xu, A. B. Birchfield, and T. J. Overbye, “Modeling, tuning, and validating system dynamics in synthetic electric grids,” *IEEE Transactions on Power Systems*, vol. 33, no. 6, pp. 6501-6509, Nov. 2018.
- [J4] J. L. Gannon, A. B. Birchfield, K. S. Shetye, and T. J. Overbye, “A comparison of peak electric fields and GICs in the Pacific Northwest using 1-D and 3-D conductivity models,” *Space Weather Journal*, no. 15, pp. 1535-1547, Nov. 2017.
- [J3] A. B. Birchfield, E. Schweitzer, M. H. Athari, T. Xu, T. J. Overbye, A. Scaglione, and Z. Wang, “A metric-based validation process to assess the realism of synthetic power grids,” *Energies*, vol. 10, no. 1233, pp. 1-14, Aug. 2017.
- [J2] A. B. Birchfield, T. Xu, K. M. Gegner, K. S. Shetye, and T. J. Overbye, “Grid structural characteristics as validation criteria for synthetic networks,” *IEEE Transactions on Power Systems*, vol. 32, no. 4, pp. 3258-3265, Jul. 2017.
- [J1] A. B. Birchfield, K. M. Gegner, T. Xu, K. S. Shetye, and T. J. Overbye, “Statistical considerations in the creation of realistic synthetic power grids for geomagnetic disturbance studies,” *IEEE Transactions on Power Systems*, vol. 32, no. 2, pp. 1502-1510, Mar. 2017.

## Conference Publications

(Mentored graduate students marked with asterisk \*, undergraduate with double asterisk \*\*)

- [C35] J. W. Xia\*\*, A. B. Birchfield, J. Snodgrass, “Undergraduate research in transmission tower physical design for synthetic electric grid cases,” *2023 Texas Power and Energy Conference (TPEC)*, College Station, TX, Feb. 2023, pp. 1-6.
- [C34] O. Oshinkoya\*, J. Baek\*, J. Kao\*\*, and A. B. Birchfield, “Preliminary analysis of the potential impact of electric vehicle fleets on large power system inertia floor,” *2023 Texas Power and Energy Conference (TPEC)*, College Station, TX, Feb. 2023, pp. 1-6.
- [C33] J. Penaranda\* and A. B. Birchfield, “Application and parameter sensitivities of a state-space cold load pickup model for a synthetic restoration test case,” *2022 North American Power Symposium (NAPS)*, Salt Lake City, UT, Sept. 2022, pp. 1-6.

- [C32] F. Safdarian *et al.*, "Grid optimization competition on synthetic and industrial power systems," *2022 North American Power Symposium (NAPS)*, Salt Lake City, UT, Sept. 2022, pp. 1-6
- [C31] A. B. Birchfield, "Inertia adequacy in transient stability models for synthetic electric grids," *11<sup>th</sup> Bulk Power Systems Dynamics and Control Symposium (IREP)*, Banff, Canada, Jul. 2022, pp. 1-8.
- [C30] A. B. Birchfield, "Graph decomposition for constructing blackstart restoration strategies in benchmark cases," *Power Systems Computation Conference (PSCC)*, Porto, Portugal, Jun. 2022. (Same paper as [J13].)
- [C29] F. Safdarian *et al.*, "Reactive power and voltage control issues associated with large penetration of distributed energy resources in power systems," *2022 IEEE Power and Energy Conference at Illinois (PECI)*, Champaign, IL, Mar. 2022, pp. 1-6
- [C28] F. Safdarian, J. Wert, Y. Liu, A. B. Birchfield, K. S. Shetye, H. Chang, and T. J. Overbye, "Reactive power and voltage control issues associated with large penetration of distributed energy resources in power systems," *Power and Energy Conference at Illinois (PECI)*, Mar. 2022.
- [C27] Y. A. Abu-Khalifa\*, A. B. Birchfield, "Techniques for creating synthetic combined electric and natural gas transmission grids," *IEEE Texas Power and Energy Conference (TPEC)*, Feb. 2022.
- [C26] T. J. Overbye, J. Snodgrass, A. B. Birchfield, M. Stevens, "Toward developing implementable high altitude electromagnetic pulse E3 mitigation strategies for large-scale electric grids," *IEEE Texas Power and Energy Conference (TPEC)*, Feb. 2022.
- [C25] G. Bhakta\*\*, A. B. Birchfield, "Applying remedial action schemes using sensitivity analysis for undergraduate research," *2021 North American Power Symposium*, Nov. 2021.
- [C24] A. B. Birchfield, T. J. Overbye, "Graph crossings in electric transmission grids," *2021 North American Power Symposium (NAPS)*, Nov. 2021.
- [C23] F. Safdarian, A. B. Birchfield, K. Shetye, and T. J. Overbye, "Additional insights in creating large-scale, high-quality synthetic grids: A case study," *Kansas Power and Energy Conference (KPEC)*, Apr. 2021.

- [C22] T. J. Overbye, J. Wert, K. S. Shetye, F. Safdarian and A. B. Birchfield, "Delaunay Triangulation Based Wide-Area Visualization of Electric Transmission Grids," *2021 IEEE Kansas Power and Energy Conference (KPEC)*, Manhattan, KS, 2021, pp. 1-6.
- [C21] A. B. Birchfield, J. Patil, R. Paredes, L. Dueñas-Osorio, "Preliminary analysis of network fragility and resilience in large electric grids," *2021 IEEE Power and Energy Conference at Illinois (PECI)*, Apr. 2021, pp. 1-6.
- [C20] T. J. Overbye, K. S. Shetye, J. Wert, W. Trinh, A. B. Birchfield, T. Rolstad, J. D. Weber, "Techniques for maintaining situational awareness during large-scale electric grid simulations", *2021 IEEE Power and Energy Conference at Illinois (PECI)*, Apr. 2021, pp. 1-8.
- [C19] T. J. Overbye, J. L. Wert, K. S. Shetye, F. Safdarian, and A. B. Birchfield, "The use of geographic data views to help with wide-area electric grid situational awareness", *2021 IEEE Texas Power and Energy Conference (TPEC)*, Feb. 2021, pp. 1-6
- [C18] K. S. Shetye, T. J. Overbye, A. B. Birchfield, J. D. Weber, and T. L. Rolstad, "Computationally efficient identification of power flow alternative solutions with application to geomagnetic disturbance analysis," *2020 IEEE Texas Power and Energy Conference (TPEC)*, Feb. 2020, pp. 1-6.
- [C17] A. B. Birchfield and T. J. Overbye, "Planning sensitivities for building contingency robustness and graph properties into large synthetic grids," *Hawaii International Conference on System Sciences*, Jan. 2020, pp. 1-8.
- [C16] Y. Zhang, K. S. Shetye, A. B. Birchfield and T. J. Overbye, "Grid impact evaluation of localized geomagnetic field enhancements using sensitivity analysis," *2019 North American Power Symposium (NAPS)*, Wichita, KS, USA, Oct. 2019, pp. 1-6
- [C15] T. J. Overbye, J. Wert, A. B. Birchfield and J. D. Weber, "Wide-Area Electric Grid Visualization Using Pseudo-Geographic Mosaic Displays," *2019 North American Power Symposium (NAPS)*, Wichita, KS, USA, Oct. 2019, pp. 1-6.
- [C14] T. Xu, H. Li, A. B. Birchfield, and T. J. Overbye, "Synthesize phasor measurement unit data using large-scale electric network models," Pre-print available: <https://arxiv.org/pdf/1909.03187.pdf>, Oct. 2019.

- [C13] T. J. Overbye, Z. Mao, A. B. Birchfield, J. D. Weber and M. Davis, "An interactive, stand-alone and multi-user power system simulator for the PMU time frame," *2019 IEEE Texas Power and Energy Conference (TPEC)*, College Station, TX, USA, Feb. 2019, pp. 1-6.
- [C12] K. S. Shetve, A. B. Birchfield, R. H. Lee, T. J. Overbye and J. L. Gannon, "Impact of 1D vs 3D earth conductivity based electric fields on geomagnetically induced currents," *2018 IEEE PES Innovative Smart Grid Technologies Conference Europe (ISGT-Europe)*, Sarajevo, 2018, pp. 1-6.
- [C11] A. B. Birchfield, H. Li, and T. J. Overbye, "Security considerations in transmission planning for creating large synthetic power grids," *Clemson University Power Systems Conference*, Charleston, South Carolina, Sept. 2018. **Second-place Best Paper Award.**
- [C10] D. Bodenmiller, A. B. Birchfield, and T. J. Overbye, "Using large-scale synthetic systems for undergraduate research in electric grid islanding," *North American Power Symposium (NAPS)*, Fargo, North Dakota, Sept. 2018.
- [C9] E. Schweitzer, T. Xu, A. B. Birchfield, A. Scaglione, T. J. Overbye, R. J. Thomas, Z. Wang, "Towards operational validation: Mapping power system inputs to operating conditions," *Power Systems Computation Conference (PSCC)*, Dublin, Ireland, Jun. 2018.
- [C8] H. Li, A. L. Bornsheuer, T. Xu, A. B. Birchfield, K. S. Shetye, and T. J. Overbye, "Load modeling in synthetic electric grids," *IEEE Texas Power and Energy Conference*, College Station, Texas, Feb. 2018.
- [C7] A. B. Birchfield, T. Xu, K. S. Shetye, and T. J. Overbye, "Building synthetic power transmission networks of many voltage levels, spanning multiple areas," *Hawaii International Conference on System Sciences*, Waikoloa Village, Hawaii, Jan. 2018.
- [C6] T. Xu, A. B. Birchfield, K. S. Shetye, and T. J. Overbye, "Creation of synthetic electric grid models for transient stability studies," *Bulk Power Systems Dynamics and Control Symposium (IREP)*, Espinho, Portugal, Sept. 2017.
- [C5] A. B. Birchfield, Z. Mao, K. S. Shetye, J. D. Weber, and T. J. Overbye, "Impact of synchronous generator model GENTPJ on system dynamics," *IEEE Power and Energy Society General Meeting*, Chicago, IL, Jul. 2017.

- [C4] A. B. Birchfield and T. J. Overbye, "Convergence characteristics of the variable projection method for mode extraction," *IEEE Texas Power and Energy Conference*, College Station, TX, Feb. 2017.
- [C3] T. Xu, A. B. Birchfield, K. M. Gegner, K. S. Shetye, and T. J. Overbye, "Application of large-scale synthetic power system models for energy economic studies," *Hawaii International Conference on System Sciences*, Jan. 2017.
- [C2] K. M. Gegner, A. B. Birchfield, T. Xu, K. S. Shetye, and T. J. Overbye, "A methodology for the creation of geographically realistic synthetic power flow models," *IEEE Power and Energy Conference at Illinois*, Champaign, IL, Jan. 2016. **Best Paper Award.**
- [C1] J. Taylor, A. B. Birchfield, "DMS simulation toolkit for the grid of the future," *CIGRE Grid of the Future Symposium*, Chicago, IL, Oct. 13, 2015.

*Technical  
Reports and  
other  
Publications*

- [R5] *Substation Instrument Transformer Testing: E1 High-Altitude Electromagnetic Pulse (HEMP) Response Measurement: Test Procedure and Results*. EPRI, Palo Alto, CA: August 7, 2020. 3002019672. (Technical Report)
- [R4] *A Time-Domain Plane Wave Coupling Model: Model Development and Validation*. EPRI, Palo Alto, CA: July 7, 2020. 3002019446. (Technical Report)
- [R3] *E3 High-Altitude Electromagnetic Pulse (HEMP) Assessment of the TEPCO Transformer Fleet: Geomagnetically Induced Current and Transformer Thermal Analysis*. EPRI, Palo Alto, CA: Mar. 25, 2020. 3002018576. (Technical Report)
- [R2] A. B. Birchfield, "The creation, validation, and application of synthetic power grids," Ph.D. Dissertation, Texas A&M University, Dec. 2018.
- [R1] A. B. Birchfield, "The creation of synthetic power grids: preliminary considerations," M.S. Thesis, University of Illinois at Urbana-Champaign, Dec. 2016.



### *Invited Sessions, Presentations and Outreach Activities*

- A. B. Birchfield, “Synthetic datasets for energy infrastructure modeling,” PSERC Webinar, Jan. 25, 2023.
- A. B. Birchfield, “Modeling and analysis of interdependent electric power grid and natural gas network,” Texas A&M Smart Grid Center Webinar Series, Sept. 23, 2022.
- Mentor, First-Generation Engineering Students Mentoring Program, Texas A&M University College of Engineering, Aug. 2021—present
- A. B. Birchfield, “Auto-layout techniques for displaying large-scale, geographically-embedded power system data,” Texas A&M Smart Grid Center Webinar Series, Jan. 19, 2022.
- A. B. Birchfield, “The design of large synthetic transmission networks and implications for grid fragility and resilience assessment,” Texas A&M ECE Department Seminar, Feb. 5, 2021.
- A. B. Birchfield, “Techniques for designing large transmission networks in synthetic electric grids,” Texas A&M Smart Grid Center Webinar Series, Dec. 10, 2020
- Power systems research laboratory exhibit, Texas A&M University Aggieland Saturday, February 10, 2018.
- A. B. Birchfield, “Getting the most out of OpenDSS with Python,” *Advanced Modeling for Distribution Planning Workshop*, College Station, TX, Apr. 20, 2017.
- A. B. Birchfield, K. M. Gegner, T. Xu, K. S. Shetye, and T. J. Overbye, “Synthetic power grids,” poster presentation at *2016 IEEE Power and Energy Society General Meeting*, Boston, MA, Jul. 19, 2016.
- “Educational electricity and magnetism medley,” exhibit at University of Illinois Engineering Open House, Mar. 11-12, 2016.  
**First Place Award in Back to School Category.**

### *Awards and Honors*

- Thomas W. Powell '62 and Powell Industries Inc. Fellowship, Texas A&M University Department of Electrical and Computer Engineering, Aug. 21, 2017.
- Grainger Power Engineering Award, University of Illinois at Urbana-Champaign, Dec. 12, 2016.
- Honorable Mention, National Science Foundation Graduate Research Fellowship Program, Mar. 29, 2016.

- Distinguished Research Fellowship, Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Aug. 2015 – Dec. 2016
- Summa Cum Laude, Honors Scholar, Auburn University, December 2014

### *Conference Leadership*

- International Advisory Committee Member, *PowerTech 2023*, Belgrade, Serbia, June 24-29, 2023
- Faculty Advisor, *TPEC 2023*, Feb 13-14, 2023
- Faculty Advisor, *TPEC 2022*, Feb 28-Mar 1, 2022
- Publications Chair, 53<sup>rd</sup> North American Power Symposium (NAPS 2021), Nov. 2021
- Committee Member, *TPEC 2019*, Feb. 7-8, 2019
- Committee Member, *TPEC 2018*, Feb. 8-9, 2018
- Chair, *2017 IEEE Texas Power and Energy Conference (TPEC)*, Feb. 9-10, 2017

### *Reviewing Activities*

- *NSF Panel Review*, Directorate for Engineering, Mar. 2022
- Reviewer, *IEEE Transactions on Power Systems*
- Reviewer, *IEEE Transactions on Smart Grid*
- Reviewer, *IEEE Open Access Journal of Power and Energy (OAJPE)*
- Reviewer, *American Geophysical Union (AGU) SpaceWeather Journal*
- Reviewer, *Hawaii International Conference on System Sciences (HICSS)*
- Reviewer, *IEEE Power and Energy Society General Meeting*
- Reviewer, *IEEE Power and Energy Conference at Illinois*
- Reviewer, *IEEE Texas Power and Energy Conference*
- Reviewer, *Clemson University Power Systems Conference*

### *Certifications and Memberships*

- Member, IEEE Industry Applications Society, Jan. 2017 – present
- Licensed Engineer-in-training (EIT), State of Texas, Jan. 2015 – present
- Member, IEEE Power and Energy Society, Jan. 2014 – present
- Member, IEEE, Jan. 2013 – present

## *Doctoral and Masters Committees*

- Melvin Stevens, Doctoral Committee Member, TBD, Advisor: T. J. Overbye.
- Jung Kyo Jung, Masters Committee Member, TBD, Advisor: T. J. Overbye.
- Anna Zhang, Masters Committee Member, TBD, Advisor: T. J. Overbye.
- Jessica Wert, Doctoral Committee Member, *Extracting Value from Electric Grid Information Towards a Resilient Grid Amidst Decarbonization Efforts*, Aug. 2023, Advisor: T. J. Overbye.
- Rida Fatima, **Masters Committee Chair**, TBD
- Oluwatoyin Oshinkoya, **Masters Committee Chair**, TBD
- Seri Kang, Masters Committee Member, TBD, Advisor: T. J. Overbye
- Yousef Abu-Khalifa, **Masters Committee Chair**, TBD
- John Penaranda, **Masters Committee Chair**, TBD
- Suraj Alimi, Masters Committee Member, TBD, Advisor: K. Butler-Purry.
- Jayant Patil, Doctoral Committee Member, **Rice University**, *Principled Surrogate Modeling for Quantitative Performance Assessment of Engineered Systems*, May 2022, Advisor: L. Dueñas-Osorio.
- Pooria Dehghanian, Doctoral Committee Member, *Thermal Assessment of Power Transformers During Geomagnetic Disturbances: Hazard Characterization, Vulnerability Assessment, and Mitigation Solutions*, Dec. 2021, Advisor: T. J. Overbye.
- Wei Trinh, Doctoral Committee Member, *The Efficient Determination of Electric Grid Modes for Large Systems Using the Matrix Pencil Method*, Jun. 2022, Advisor: T.J. Overbye.
- Yijing Liu, Doctoral Committee Member, *Techniques for Improving Dynamic Performance within Large-scale Electric Grids with High Penetration of Renewable Generation*, May 2022, Advisor: T. J. Overbye.
- Ramyaa Kumar, **Masters Committee Chair**, *Considerations for Real-Time Data Analysis Using Multiple Magnetometer Sources for GIC Studies to Improve the Situational Awareness of an Electric Grid Model*, Aug. 2021.