

Curriculum Vitae Dr. James Cale

Associate Professor, Systems and Electrical & Computer Engineering Departments
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EDUCATION

DOCTORATE IN ELECTRICAL ENGINEERING Aug '07
Purdue University, Energy Sources and Systems (West Lafayette, IN)
Dissertation Title: Computationally efficient magnetic modeling and material characterization methods for automated ferrimagnetic inductor design
Major Advisor: Prof. Scott Sudhoff, FIEEE

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING Dec '03
Purdue University, Energy Sources and Systems (West Lafayette, IN)

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING (SUMMA CUM LAUDE) Dec '01
Missouri University of Science & Technology (Rolla, MO)

APPOINTMENTS

ASSOCIATE PROFESSOR, SYSTEMS ENGINEERING AND ECE DEPARTMENTS Jul '17–
Colorado State University Fort Collins, CO

CHIEF TECHNOLOGY OFFICER Sept '22–Sept '23
Moser Energy Systems Evansville, WY

PROFESSIONAL EXPERIENCE

PRINCIPAL & LEAD, INTEGRATED DEVICES & SYSTEMS Jun '11–Jul '17
National Renewable Energy Laboratory Golden, CO

Led a group focusing on the integration of high-penetration renewable generation on the electrical grid. Performed high-fidelity, transient modeling and simulation of power converters in MATLAB/Simulink, PSCAD and Python. Wrote grant proposals with national laboratory, academic and industrial partners for Department of Energy funding. Led a project on advanced remote hardware-in-the-loop for creating virtually connected energy testbeds. Performed research in machine learning and pattern classification using principle components analysis (PCA) and k -means clustering.

MEMBER OF TECHNICAL STAFF May '10–Jun '11
Controls and Modeling Group, Advanced Energy Fort Collins, CO

Technical lead for modeling and simulation of power inverters for detailed design and optimization studies to support firmware design. Simulations were performed for validation of performance and control stability margins. Championed the use of test-driven software development and initiated a documentation procedure for firmware code, design calculations, and software interfaces. Derived state-space models for the inverter and magnetic components such as transformers and chokes for EMI reduction. Developed a hardware-in-the-loop testing platform using National Instruments PXI chassis.

LEAD ELECTRICAL ENGINEER Jan '08–Apr '10
Research and Development, Orbital ATK Ogden, UT

Principal Investigator for Department of Defense research projects. Designed advanced magnetic sensing, data acquisition and real-time pattern recognition system using both PCA and support vector machine classification technique.

POST-DOCTORAL RESEARCH ENGINEER
Computational Magnetics Group, Purdue University

Jul '07–Jan '08
West Lafayette, IN

Simulated 3D time-domain electromagnetic fields in next-generation integrated circuits using C/C++ using time-domain magnetic Finite Element Analysis (FEA). Wrote code for automating geometry and trace extraction from Cadence/Allegro.

PUBLICATIONS

- [1] S. Frank, B. Ball, D. L. Gerber, K. Cu, A. Othee, J. Shackelford, O. Ghatpande, R. Brown, and **Cale, J.**, “Advances in the co-simulation of detailed electrical and whole-building energy performance,” *Energies*, vol. 16, no. 17, 2023.
- [2] C. Lima and **Cale, J.**, “Control design for position synchronization in central converter multi-machine actuators,” in *Proc. of the International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME 2023)*, Tenerife, Spain, July 19–21, 2023 (accepted, to appear).
- [3] A. Othee, **Cale, J.**, A. Santos, S. Frank, D. Zimmerle, O. Ghatpande, G. Duggan, and D. Gerber, “A modeling toolkit for comparing AC versus DC electrical distribution efficiency in buildings,” *Energies* 2023, 16(7), Mar, 2023.
- [4] C. Lima, Z. Miller, A. Riley, **Cale, J.**, and et al., “A novel electromechanical actuation testbed for emulation of aerospace actuation systems,” in *33rd Aerospace Testing Seminar*, El Segundo, CA (USA), May 15, 2023 (accepted, to appear).
- [5] R. Pirani and **Cale, J.**, “Comparison of pattern recognition approaches for identification of failure-prone battery cells,” in *2022 IEEE Systems Engineering Conference (SYSCON)*, 2022, Montreal, Canada, April 25–28, 2022.
- [6] C. Lima and **Cale, J.**, “Rotor position synchronization control in central-converter multi-motor topologies,” in *IEEE Power and Energy Systems General Meeting, 2022*, Denver, CO (USA), July 17–21 (abstract and poster session).
- [7] C. Lima, **Cale, J.**, and K. Shahroudi, “Rotor position synchronization in central-converter multi-motor electric actuation systems,” *Energies* 2021, 14(14), Nov, 2021.
- [8] C. Lute, **Cale, J.**, G. Ross, D. Moorman, and M. Dorflinger, “Evaluating power and environmental performance in mobile microgrid generator systems,” *International Journal of Electrical Power and Energy Systems*, vol. 121, Oct. 2021.
- [9] **Cale, J.**, C. Lute, G. Ross, and A. Othee, “Characterization procedure for unsymmetrical split-phase capacitor-start induction machines,” *IEEE Open Access Journal on Power and Energy*, vol. 8, Oct. 2020.
- [10] **Cale, J.**, C. Lute, J. Simon, and A. Delcore, “Modeling minimally-processed transformers for shielded metal arc welders for rural minigrid applications,” *IEEE Power and Energy Technology Systems Journal*, vol. 6, no. 2, pp. 95–103, Jun. 2019.
- [11] A. Santos, **Cale, J.**, A. Othee, D. Gerber, S. Frank, D. Zimmerle, and G. Duggan, “Comparison of load models for estimating electrical efficiency in DC microgrids,” in *Proceedings of the 3rd IEEE International Conference on DC Microgrids, 2019*, Matsue, Japan, 2019.

- [12] C. Lute, T. Decker, **Cale, J.**, and A. Delcore, "A method for evaluating unregulated solar irrigation pumping systems: Results and observations," in *2019 IEEE Global Humanitarian Technology Conference (GHTC), 2019*, Seattle, WA, 2019.
- [13] R. Pirani and **Cale, J.**, "A pattern recognition approach for enhancing lifecycle maintainability of battery systems," in *2019 International Symposium on Systems Engineering (ISSE), 2019*, Edinburgh, Scotland, 2019, pp. 1–8.
- [14] **Cale, J.**, E. Dall'Anese, B. Johnson, P. Young, G. Duggan, P. Bedge, D. Zimmerle, and L. Holton, "Mitigating communication delays in remotely connected hardware-in-the-loop experiments," *IEEE Transactions on Industrial Electronics*, vol. 65, no. 12, pp. 9739–9748, 2018.
- [15] M. Brim and **Cale, J.**, "Remote and dynamic assessment of reliability in electromechanical actuator systems," in *Proceedings of the 12th IEEE International Systems Conference, 2018*, Vancouver, Canada, 2018, pp. 1–8.
- [16] **Cale, J.**, "Converging on emergence: reconnoitering to optimally adapt to changes in system environment," in *Proceedings of the 4th IEEE International Symposium on Systems Engineering, 2018*, Rome, Italy, 2018, pp. 1–7.
- [17] N. Ainsworth, C. Heaps, M. Symko-Davies, and **Cale, J.**, "U.S. SOCOM Grand Challenge #3: NREL Technical Roadmap for a Man-Portable Power Supply System for TALOS," National Renewable Energy Laboratory, Technical Report NREL/TP-5D00-65985, 2016.
- [18] B. Johnson, S. Dhople, **Cale, J.**, A. Hamadeh, and P. Krein, "Oscillator-based inverter controls for islanded three-phase microgrids," *IEEE Journal of Photovoltaics*, vol. 4, no. 1, pp. 387–395, 2014.
- [19] **Cale, J.**, B. Palmintier, D. Narang, and K. Carroll, "Clustering distribution feeders in the Arizona Public Service territory," in *Proceedings of the 40th IEEE Photovoltaic Specialist Conference (PVSC), 2014*, Denver, Colorado (USA), 2014, pp. 2076–2081.
- [20] P. Gotseff, **Cale, J.**, M. Baggu, D. Narang, and K. Carroll, "Accurate power prediction of spatially distributed PV systems using localized irradiance measurements," in *Proceedings of the Power and Energy Systems (PES) Conference, 2014 IEEE*, Washington, DC (USA), 2014, pp. 1–5.
- [21] **Cale, J.** and D. Narang, "High-penetration PV deployment in the Arizona Public Service system, Phase 2 results and update on Phase 3," in *Proceedings of the 39th IEEE Photovoltaic Specialist Conference (PVSC), 2013*, Tampa, Florida (USA), Jun. 2013, pp. 1711–1714.
- [22] M. Ropp, **Cale, J.**, and M. Mills-Price, "A test protocol to enable comparative evaluation of maximum power point trackers," in *Proceedings of the 37th IEEE Photovoltaic Specialists Conference, 2011*, Seattle, Washington (USA), Jun. 2011, p. 4.
- [23] **Cale, J.**, S. Sudhoff, and R. Chan, "Ferrimagnetic inductor design using population-based design algorithms," *IEEE Transactions on Magnetics*, vol. 45, no. 2, pp. 726–734, Feb. 2009.
- [24] **Cale, J.** and Sudhoff, S. and Chan, R., "A field-extrema hysteresis model for ferrimagnetic materials," *IEEE Transactions on Magnetics*, vol. 44, no. 7, pp. 1728–1736, 2008.
- [25] **Cale, J.**, "Computationally efficient magnetic modeling and material characterization methods for automated ferrimagnetic inductor design," Ph.D. dissertation, Purdue University, School of Electrical and Computer Engineering, 2007.

- [26] **Cale, J.** and S. Sudhoff, “EI core inductor designs using population-based design algorithms,” in *IEEE Applied Power Electronics Conference, 2007*, Anaheim, CA (USA), March 2007, pp. 1062–1069.
- [27] B. Cassimer, R. Chan, **Cale, J.**, A. Cramer, and S. Sudhoff, “Evolutionary design of electromagnetic and electromechanical devices,” in *IEEE Electric Ship Technologies Symposium, 2007*, no. 21, Arlington, Virginia (USA), May 2007, pp. 150–157.
- [28] **Cale, J.**, S. Sudhoff, and J. Turner, “An improved magnetic characterization method for highly permeable materials,” *IEEE Transactions on Magnetics*, vol. 42, no. 8, pp. 1974–1981, Aug. 2006.
- [29] **Cale, J.**, S. Sudhoff, and L. Tan, “Accurately modeling EI core inductors using a high-fidelity magnetic equivalent circuit approach,” *IEEE Transactions on Magnetics*, vol. 42, no. 1, pp. 40–46, Jan. 2006.
- [30] S. Sudhoff, **Cale, J.**, B. Cassimer, and M. Swinney, “Genetic algorithm based design of a permanent magnet synchronous machine,” in *IEEE Electric Machines and Drives Conference, 2005*, San Antonio, Texas (USA), May 2005, pp. 1011–1019.
- [31] J. Williams, **Cale, J.**, N. Benavides, J. Wooldridge, A. Koenig, J. Tichenor, and S. Pekarek, “Versatile hardware and software tools for educating students in power electronics,” *IEEE Transactions on Education*, vol. 47, no. 4, pp. 436–445, Nov. 2004.

PATENTS

- [1] M. Polley, D. Micic, K. Shahroudi, J. Kopecek, and **Cale, J.**, “Jam detection and jam tolerant motion control,” Issued: U.S. Patent 2023/0 061 579, Mar. 31, 2023.
- [2] **Cale, J.**, E. Dall’Anese, B. Johnson, P. Young, L. Holton, and D. Zimmerle, “Mitigating latency errors in distributed systems,” Applied: U.S. Patent 2017/0 249 404 A1, Aug. 31, 2017.
- [3] S. Sudhoff and **Cale, J.**, “Methods and apparatus for characterizing magnetic properties of materials,” Issued: U.S. Patent 8,633,686 B1, Jan. 21, 2014.

EDITORIAL AND CONFERENCE DUTIES

- Editor for the *IEEE Power and Energy Systems Technology Journal* (2015–2022)
- Guest Editor for *Energies: Special Issue on Modeling and Simulation of Power Systems and Power Electronics* (2021)
- Organizer and host for the 2019 Fort Collins International Symposium on Microgrids (2019)
- Editorial reviewer for numerous scholarly journals including *IEEE Transactions on Energy Conversion*, *IEEE Transactions on Sustainable Energy*, and *IEEE Transactions on Industrial Electronics*, and *Journal of Applied Energy*.

HONORS & AWARDS

- Recipient of the CSU Excellence in Teaching Award (2022)
- Recipient of the NREL Chairman’s Award (2014)
- Recipient of the NREL Presidents’s Award (2012)
- Awarded the National Science Foundation (IGERT) Graduate Fellowship (2002–2005)
- Recipient of the Grainger Outstanding Power Engineering Student Award (2001), (2006)
- UMR Curator’s Scholarship (2001)
- UMR ECE Departmental Scholarship (2001)
- Received merit-based grant from General Motors Corporation (2000)
- Received merit-based grant from McDonald Douglas Corporation (2000)

COMMUNITY AND PROFESSIONAL SERVICE

- Mentor for high school student on senior project (Loveland High School, 2018)
- Invited speaker for Poudre School District Gifted Student Program (2017)
- Member of the Industrial Advisory Board (IAB) at Colorado State University (2014–2017)

PROFESSIONAL SOCIETIES

- Tau Beta Pi—National Engineering Honor Society
- Phi Kappa Phi—National Scholastic Honor Society
- Kappa Mu Epsilon—National Mathematics Honor Society
- Eta Kappa Nu—Electrical Engineering Honor Society
- IEEE (Senior Member)—Institute of Electrical and Electronics Engineers

TEACHING EXPERIENCE

ECE 565 - ELECTRICAL POWER ENGINEERING <i>Instructor, Colorado State University</i>	Fall '21–'23
ECE 461 - POWER SYSTEMS <i>Instructor, Colorado State University</i>	Fall '21–'23
ECE 566 - GRID INTEGRATION OF WIND ENERGY SYSTEMS <i>Instructor, Colorado State University</i>	Spring '21–'23
ENGR 597 - DYNAMIC SYSTEM OPTIMIZATION UNDER UNCERTAINTY <i>Course Developer & Instructor, Colorado State University</i>	Fall '19
ENGR 570 - COUPLED ELECTROMECHANICAL SYSTEMS <i>Course Developer & Instructor, Colorado State University</i>	Fall '17–'22
ENGR 530 - OVERVIEW OF SYSTEMS ENGINEERING PROCESSES <i>Instructor, Colorado State University</i>	Spring '16–'22
ENGR 531 - ENGINEERING RISK ANALYSIS <i>Instructor, Colorado State University</i>	Spring '17–'23
ECE 321 - ELECTROMECHANICAL MOTION DEVICES <i>Instructor, Purdue University</i>	Spring '05
POWER ELECTRONIC DRIVE SYSTEMS (SHORTCOURSE) <i>Instructor, Fairfield Engineering</i>	Fall '04