

Exponent®
Engineering & Scientific Consulting

Peter Lindahl, Ph.D., P.E., CFEI

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Professional Profile

Dr. Lindahl is an electrical engineer with expertise in power systems, electromechanical machinery (motors and generators), electrochemical systems (e.g. batteries, fuel cells, and their associated electronics), and renewable and distributed energy systems, including photovoltaic (PV) systems ranging from small residential rooftop installations to large utility scale PV generation facilities. He also has expertise in sensors, instrumentation, and signal processing, and applies this expertise to conduct data-driven investigations of equipment and systems, from large industrial control centers to small consumer electronics and medical devices. His professional activities involve, amongst others, conducting complex investigations related to product safety, reliability, failures, and standards compliance; advising clients and providing engineering services on matters concerning intellectual property; and developing condition monitoring and fault detection and isolation techniques.

Prior to Exponent, Dr. Lindahl was a postdoctoral associate at the Massachusetts Institute of Technology. While there, he conducted research and oversaw graduate student projects related to smart grid power management and control, condition monitoring in electrical and mechanical systems, and smart building technology development including capacitive occupancy sensing and HVAC performance tracking via smart meter measurements. He received his PhD from Montana State University for his work devising sensing methods and power control management schemes for solid oxide fuel cell systems.

Throughout his career, Dr. Lindahl has provided technical and scientific services to clients in a variety of industries including aerospace, construction, electrical power, oil and gas, automotive and marine transportation, consumer electronics, medical devices and equipment, and national defense. He's co-authored over three dozen technical research articles in high-impact academic journals and conference proceedings, published a book chapter on photovoltaics and the environment, and was awarded a patent regarding recognizing electrical service events and autonomizing load dispatch. His research work has also been featured in news outlets and engineering society magazines including MIT News, the SNAME Marine Technology Magazine, and the IEEE Instrumentation & Measurement Magazine.

Academic Credentials & Professional Honors

Ph.D., Engineering, Montana State University, 2013

M.S., Electrical Engineering, Montana State University, 2009

B.S., Electrical Engineering, Penn State University, 2003

Research Affiliate, Research Laboratory of Electronics, Massachusetts Institute of Technology

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Licenses and Certifications

Professional Engineer Electrical, California, #25012

Certified Fire and Explosion Investigator (CFEI)

Academic Appointments

MIT - Massachusetts Institute of Technology, Research Laboratory of Electronics (RLE), Research Affiliate/Research Scientist

Postdoctoral Associate, Research Laboratory of Electronics, Massachusetts Institute of Technology, 2014 - 2019

Communication Lab Advisor, Electrical Engineering & Computer Science Department, Massachusetts Institute of Technology, 2015 - 2018

Assistant Teaching Professor & Research Engineer, Electrical & Computer Engineering Department, Montana State University, 2013 - 2014

Ph.D. Research Assistant, Electrical & Computer Engineering Department, Montana State University, 2009 - 2013

M.S. Research Assistant, Electrical & Computer Engineering Department, Montana State University, 2006 - 2009

Undergraduate Summer Researcher, Department of Physics, University of Maryland, Baltimore County, 2000 - 2002

Prior Experience

Assistant Project Engineer, Cianbro Corporation, Baltimore, MD 2006

Field Engineer & Electrical Estimator, Cianbro Corporation, Baltimore, MD, 2005-2006

Professional Affiliations

Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

Member, Tau Beta Pi Engineering Honors Society

Patents

US Patent 12, 107, 421: Waveform Transient Identification and Autonomous Load Coordination, October 2024 (Leeb SB, Lindahl, PA, Nowocin, JK, Shabshab, S).

Publications

M. Mughal, U. Zia, L. Freeman, P. Lindahl. “Empowering a Resilient Grid: Navigating the Environmental Challenges of Photovoltaic System Integration”. In B. D’Andrade (Ed.). The Sustainable Power Grid Challenges, Applications, and Case Studies. Elsevier. In Press.

P. Verghese, P. Lindahl, H. Kytomaa, M. Little. "Glass Analysis in a Metal Halide Lamp Warehouse Fire Investigation". National Association of Fire Investigators (NAFI) International Symposium on Fire

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D. Green, P. Lindahl and S. Leeb, "Three-Phase Electrical Measurement Representations for Nonintrusive Load Diagnostics," IEEE Open Journal of Instrumentation and Measurement, vol. 1, pp. 1-14, 2022, Art no. 3500514, doi: 10.1109/OJIM.2022.3203444.

D. Green, D. Quinn, S. Madden, P. Lindahl and S. Leeb, "Nonintrusive Measurements for Detecting Progressive Equipment Faults," IEEE Transactions on Instrumentation and Measurement, vol. 71, pp. 1-12, 2022, Art no. 3518112, doi: 10.1109/TIM.2022.3193178.

A. Kattamis, P. Lindahl. “The Smarter the Home, the More Expensive the Lightning-Caused Insurance Claim”. Exponent Thought Leadership. May 2021.

M. Gutierrez, P. Lindahl, S. Leeb, "Constant Power Load Modeling for a Programmable Impedance Control Strategy," IEEE Transactions on Industrial Electronics, vol. 69, no. 1, pp. 293-301, Jan. 2022, doi: 10.1109/TIE.2020.3048323.

E. Ponce, S. Leeb, P. Lindahl. "Know the Flow: Non-Contact Magnetic Flow Rate Sensing for Water Meters". IEEE Sensors Journal, vol. 21, no. 1, pp. 802-811, 1 Jan.1, 2021.

P. Lindahl, M. Ali, P. Armstrong, A. Aboulian, J. Donnal, L. Norford, S. Leeb. "Nonintrusive Load Monitoring of Variable Speed Drive Cooling Systems". IEEE Access, vol. 8, pp. 211451-211463, 2020.

S. Shabshab, P. Lindahl, S. Leeb, J. Nowocin. "Autonomous Demand Smoothing for Efficiency Improvements on Military Forward Operating Bases". IEEE Transactions on Power Delivery, vol. 35, no. 5, pp. 2243-2251, Oct. 2020.

D. Green, T. Kane, S. Kidwell, P. Lindahl, J. Donnal and S. Leeb. "NILM dashboard: Actionable feedback for condition-based maintenance". IEEE Instrumentation & Measurement Magazine, vol. 23, no. 5, pp. 3-10, Aug. 2020.

L. Huchel, J. Helsen, P. Lindahl, S. Leeb. “Diagnostics for Periodically Excited Actuators”. IEEE Transactions on Instrumentation & Measurement, vol. 69, no. 7, pp. 4145-4153, July 2020.

J. Berger, D. Burnett, P. Lindahl, A. Kattamis, “Improving the Speed and Accuracy of Fire Investigations: How IoT and Connected Devices Can Help Determine Root Cause”. Exponent Thought Leadership. June 2020.

S. Shabshab, P. Lindahl, J. Nowocin, J. Donnal, D. Blum, L. Norford, S. Leeb. “Demand Smoothing in Military Microgrids Through Coordinated Direct Load Control”. IEEE Transactions on Smart Grid. Vol. 11, no. 3, pp. 1917-1927, May 2020.

D. Green, S. Shaw, P. Lindahl, T. Kane, J. Donnal, S. Leeb. “A Multiscale Framework for Nonintrusive Load Identification”. IEEE Transactions on Industrial Informatics. Vol. 16, no. 2, pp. 992-1002, Feb. 2020.

S. Kidwell, T. Kane, D. Green, J. Donnal, P. Lindahl, S. Leeb, H. Zeineldin, V. Khadkikar, M. El Moursi. “NILM Dashboard: Power System Monitoring for Condition-Based Maintenance”. Naval Engineering Journal. Vol. 131, no. 4, pp. 73-81. Dec. 2019.

D. Green, P. Lindahl, S. Leeb, T. Kane, S. Kidwell, J. Donnal. “Dashboard: Nonintrusive Electromechanical Fault Detection and Diagnostics”. IEEE AUTOTESTCON 2019. Aug. 2019.

S. Shabshab, P. Lindahl, J. Nowocin, S. Leeb. "Voltage Waveform Transient Identification for Autonomous Load Coordination". IEEE Access. Vol. 7, pp. 123128-123137. Aug. 2019.

S. Kidwell, T. Kane, D. Green, J. Donnal, P. Lindahl, S. Leeb. "NILM Dashboard: Power System

Monitoring for Condition-Based Maintenance". American Society for Naval Engineers Technology, Systems & Ships. June 2019.

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S. Leeb, P. Lindahl, D. Green, T. Kane, J. Donnal, S. Kidwell. "Power as Predictor and Protector". Marine Technology. A publication of the Society of Naval Architects and Marine Engineers. April 2019.

C. Peeters, Q. Leclere, J. Antoni, P. Lindahl, J. Donnal, S. Leeb, J. Helsen. "Review and Comparison of Tacholess Instantaneous Speed Estimation Methods on Experimental Vibration Data". Mechanical Systems and Signal Processing. Vol. 129, pp. 407-436. April 2019.

T. Kane, D. Green, G. Bredariol, P. Lindahl, J. Donnal, S. Leeb. "Non-Intrusive Monitoring for Shipboard Log Generation". American Society for Naval Engineers Intelligent Ships Symposium. April 2019.

A. Aboulian, D. Green, J. Switzer, T. Kane, G. Bredariol, P. Lindahl, J. Donnal, S. Leeb. "NILM Dashboard: A Power System Monitor for Electromechanical Equipment Diagnostics". IEEE Transactions on Industrial Informatics. Vol. 15, no. 3, pp.1405-1414, Mar. 2019.

P. Lindahl, D. Green, G. Bredariol, A. Aboulian, J. Donnal, S. Leeb. "Shipboard Fault Detection Through Nonintrusive Load Monitoring: A Case Study". IEEE Sensors Journal. Vol. 18, no. 21, pp. 8986-8995, Nov. 2018.

S. Shabshab, J. Nowocin, P. Lindahl, S. Leeb. "Microgrid Modeling and Fuel Savings Opportunities Through Direct Load Control". IECON2018 - 44th Annual Conference of the IEEE Industrial Electronics Society. Oct. 2018.

P. Lindahl, S. Leeb, S. Shaw. "Fuel Cell Stack Emulation for Cell and Hardware-in-the-Loop Studies". IEEE Transactions on Instrumentation & Measurement. Vol. 67, no. 9, pp. 2143-2152, Sept. 2018.

M. Gutierrez, P. Lindahl, A. Banerjee, S. Leeb. "Controlling the Input Impedance of Constant Power Loads". IEEE Applied Power Electronics Conference. Mar. 2018.

T. Kane, D. Green, A. Aboulian, G. Bredariol, J. Donnal, P. Lindahl, S. Leeb. "NILM: Smarter Shipboard Monitoring for the Modern Fleet". American Society for Naval Engineers Advanced Machinery Technology Symposium. Mar. 2018.

P. Lindahl, G. Bredariol, J. Donnal, S. Leeb. "Noncontact Electrical System Monitoring on a US Coast Guard Cutter". IEEE Instrumentation & Measurement Magazine. Vol. 20, no. 4, pp. 11-20, Aug. 2017.

J. Donnal, P. Lindahl, D. Lawrence, R. Zachar, S. Leeb. "Untangling Non-Contact Power Monitoring Puzzles". IEEE Sensors Journal. Vol. 17, no. 11, pp. 3542-3550, June 2017.

A. Hanson, P. Lindahl, S. Strasser, A. Takemura, D. Englund, J. Goldstein. "Technical Communication Instruction for Graduate Students: The Communication Lab vs. A Course". American Society for Engineering Education Annual Conference & Exposition. June 2017.

J. Nation, G. Bredariol, A. Aboulian, D. Green, K. Stevens, J. Donnal, P. Lindahl, S. Leeb. "Nonintrusive Monitoring for Shipboard Fault Detection". 2017 IEEE Sensors Applications Symposium. Mar. 2017.

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G. Bredariol, K. Stevens, J. Nation, A. Aboulian, P. Lindahl, S. Leeb. "NILM: A Smarter Tactical Decision

Aid". American Society of Naval Engineers Technology, Systems & Ships Day. Feb. 2017.

P. Lindahl, A. Avestruz, W. Thompson, E. George, B. Sennett, S. Leeb. "A Transmitter-Receiver System for Long-Range Capacitive Sensing Applications". IEEE Transactions on Instrumentation and Measurement. Vol. 65, no. 10, pp. 2412-2423, Oct. 2016.

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J. Moon, P. Lindahl, J. Donnal, R. Zachar, C. Schantz, W. Cotta, S. Leeb. "A Nonintrusive Magnetically Self-powered Vibration Sensor for Automated Condition Monitoring of Electromechanical Machines". IEEE AUTOTESTCON 2016. Sept. 2016.

R. Zachar, P. Lindahl, J. Donnal, W. Cotta, C. Schantz, S. Leeb. "Utilizing Spin-down Transients for Vibration-Based Diagnostics of Resiliently Mounted Machines". IEEE Transactions on Instrumentation and Measurement. Vol. 65,no. 7,pp. 1641-1650. July 2016.

J. Cooley, P. Lindahl, C. Zimmerman, M. Cornachione, G. Jordan, S. Shaw, S. Leeb. "Multiconverter System Design for Fuel Cell Buffering and Diagnostics under UAV Load Profiles". IEEE Transactions on Power Electronics. Vol. 29, no. 6, pp. 3232-3244. June 2014.

P. Lindahl, M. Cornachione, J. Wold, X. Hu, S. Shaw. "Solid Oxide Fuel Cell Degradation, Recovery, and Control Via the Electrical Terminals". ASME Fuel Cell Science, Engineering, and Technology Conference. June 2014.

P. Lindahl, M. Cornachione, S. Shaw. "A Time-Domain Least Squares Approach to Electrochemical Impedance Spectroscopy". IEEE Transactions on Instrumentation and Measurement. Vol. 61, no. 12, pp. 3303-3311. Dec. 2012.

P. Lindahl, E. Moog, S. Shaw. "Simulation, Design, and Validation of a UAV SOFC Propulsion System". IEEE Transactions on Aerospace and Electronic Systems. Vol. 48, no. 3, pp. 2582-2593. July 2012.

S. Sofie, S. Shaw, P. Lindahl, L. Spangler. "Propulsion and Power Rapid Response R&D Support. Support Delivery Orders 0002 & 0041. Power-Dense, Solid Oxide Fuel Cell Systems: High-Performance, High-Power-Density Solid Oxide Fuel Cells, Materials and Load Control". Air Force Research Laboratory Propulsion Directorate. 2008-2010.

P. Lindahl, M. Cornachione, S. Shaw. "A Reference Based Fuel Cell Stack Simulator". ASME Fuel Cell Science, Engineering, and Technology Conference. July 2010.

P. Lindahl, E. Moog, S. Shaw. "Simulation, Design, and Validation of a UAV SOFC Propulsion System". IEEE Aerospace Conference. Mar. 2009.

L. Hayden, A. Sinyukov, M. Leahy, P. Lindahl, J. French, W. Herman, M. He, R. Twieg. "New Materials for Optical Rectification and Electro-optic Sampling of Ultra-short Pulses in the THz Regime". Journal of Polymer Science PartB: Polymer Physics. Vol. 41, pp. 2492-2500. Nov. 2003.

Presentations

S. Shabshab, J. Nowocin, P. Lindahl, S. Leeb. "Microgrid Modeling and Fuel Savings Opportunities Through Direct Load Control". Oral Presentation. IECON2018 - 44th Annual Conference of the IEEE Industrial Electronics Society. Oct. 2018.

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J. Donnal, C. Schantz, J. Moon, P. Lindahl, S. Leeb. "Stethoscopes for Nonintrusive Monitoring". Oral Presentation. 2017 IEEE Sensors Applications Symposium. Mar. 2017.

P. Lindahl, A. Aboulian, J. Nowocin, S. Shabshab, P. Armstrong, S. Leeb. "HVAC Efficiency Tracking with Nonintrusive Load Monitoring". Poster Presentation. MIT Energy Initiative 2016 Annual Research Conference. Nov. 2016.

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Editorships & Editorial Review Boards

Technical Session Chair, 2017 IEEE Sensors Application Symposium

Peer Reviews

IEEE Transactions on Energy Conversion 2009–Present

IEEE Transactions on Instrumentation & Measurement 2010–Present

Energy Efficiency Oct. 2015–Present

IEEE Sensors Journal Jan. 2016–Present

IEEE Access March 2019–Present