# Peter A. Lindahl


## Mailing Address

Massachusetts Institute of Technology
77 Massachusetts Ave. Rm 10-007
Cambridge, MA 02139

## Contact Information

http://lindahl.mit.edu
lindahl@mit.edu
+1 (443) 745-1604


## Education

**Doctor of Philosophy, Engineering** — May 2009 – May 2013
Montana State University, Bozeman, MT, USA
Dissertation: *Electric Terminal Performance and Diagnostics of Solid Oxide Fuel Cells and Systems*
Advisor: Dr. Steven R. Shaw

**Master of Science, Electrical Engineering** — Aug. 2006 – May 2009
Montana State University, Bozeman, MT, USA
Thesis: *Simulation, Design, and Validation of a Solid Oxide Fuel Cell Powered Propulsion System for an Unmanned Aerial Vehicle*
Advisor: Dr. Steven R. Shaw

**Bachelor of Science, Electrical Engineering**
Pennsylvania State University, University Park, PA, USA — Aug. 2001 – May 2003
Syracuse University, Syracuse, NY, USA — Aug. 1999 – May 2001

## Academic Appointments

**Massachusetts Institute of Technology**, Cambridge, MA, USA
*Postdoctoral Associate*, Research Laboratory of Electronics — June 2014 – Present
Mentor: Dr. Steven B. Leeb

Manage and oversee multiple research projects related to instrumentation, control, and optimization of advanced energy and electrical systems; co-advise graduate students and assist with classes.

- Lead the energy monitoring research portion of a flagship MIT & Masdar Institute collaboration developing new urban microclimate models and building control schemes in order to reduce the energy lost to urban heat islanding effects in highly urbanized areas like Abu Dhabi.
- Develop methods for tracking energy utilization and cooling efficiency of a centralized air conditioner from characteristics of a building's electricity demand (e.g. harmonic content).
- Design, test, and automate diagnostic techniques for optimizing and increasing sustainability of electrical, mechanical, and water distribution systems. Specific projects include a root cause vibrational fault detection method for electromechanical machines aboard U.S. Navy ships, and a method for detecting residential water leaks in water-scarce countries such as Kuwait and United Arab Emirates.
- Advise students (to date: 3 Ph.D. students, 5 M.S. students, and 1 undergraduate student) on research topics including non-intrusive sensing, micro-grid energy management, electric motor and generator diagnostics, and power electronic control of distributed energy sources and loads.
- Organize laboratory assignments and teach technical workshops for three courses: a power electronics lab, a microcontroller project lab, and an introductory production & design course.

*Communication Lab Advisor*, Dept. of Elec. Eng. & Comp. Sci. — Oct. 2015 – Present

Mentor graduate students and postdocs on effective technical communication and develop teaching resources for courses and workshops.

- Hold one-on-one coaching sessions (approximately 40 to date) with graduate students and postdocs providing them with guidance on communication pieces including faculty applications, journal papers, and conference presentations and posters.
- Generated teaching materials and led recitation workshops for a pilot graduate-level technical communication course with 20 students this past Spring semester.

## Academic Appointments Continued

**Montana State University**, Bozeman, MT, USA

*Research Engineer*, College of Engineering — Mar. 2014 - June 2014

Performed a technical design and performance analysis of novel capacitance-based position sensors and high-speed focus controls for micro-electro-mechanical (MEMS) deformable mirrors built in the lab of Dr. David Dickensheets.

*Assistant Teaching Professor*, Electrical & Computer Engineering Department — Aug. 2013 - Dec. 2013

Taught a lecture and laboratory course in applied electric power and supervised recitations for a multidisciplinary engineering design course.

- Created teaching content and laboratory assignments, gave lectures, and supervised labs for teaching electrical engineering concepts including circuit analysis, AC power, and electromechanical machinery to 35 construction engineering technology students.
- Provided project advice and guidance to 4 multidisciplinary design teams of 6 students each regarding the engineering design process, project management, and technical leadership.

*Ph. D. Research Assistant*, Electrical & Computer Engineering Department — May 2009 - May 2013

Advisor: Dr. Steven R. Shaw

Led a Boeing-funded research project studying solid oxide fuel cell and load interactions, in-situ degradation analysis, and control opportunities for fuel cell degradation mitigation.

- Designed and built a reference-based fuel cell stack simulator capable of supplying approximately 300 W for testing prototype fuel cell technologies under full-scale power electronic loads such as lighting ballasts and motor drives.
- Developed a time-domain least squares-based approach to electrochemical impedance spectroscopy for non-intrusive diagnostics of fuel cells and detecting degradation mechanisms such as anode oxidation.
- Proposed and demonstrated the novel concept of mitigating a fuel cell stack's degradation by controlling the stack load profile based on the stack's electrochemical impedance characteristics.

*M. S. Research Assistant*, Electrical & Computer Engineering Department — Aug. 2006 - May 2009

Advisor: Dr. Steven R. Shaw

Led an Air Force Research Laboratory-funded research project studying solid oxide fuel cells for powering the propulsion of an unmanned aerial vehicle.

- Developed a steady-state simulation model for a brushless DC electric motor and propeller propulsion system powered from a solid oxide fuel cell stack.
- Validated simulation model by designing and constructing a testing facility to evaluate the performance of several multi-kW electrical propulsion systems powered by an emulated fuel cell source.

**University of Maryland, Baltimore County**, Baltimore, MD, USA

*Undergraduate Researcher*, Department of Physics — Summers 2000, 2002

Advisor: Dr. L. Michael Hayden

Developed and conducted experiments studying non-linear electro-optic effects in polymeric media.

**Syracuse University**, Syracuse, NY, USA

*Calculus Tutor*, Mathematics Department — Fall 2000 – Spring 2001

Tutored fellow students taking undergraduate calculus or business calculus classes.

## Industry Experience

**Cianbro Corporation**, Baltimore, MD, USA

*Assistant Project Engineer* — Mar. 2006 - July 2006

Assisted in planning and implementing the installation of a new water intake and pumping system for the Milford Power Plant Water Intake Project.

- Aided project superintendent and the head project engineer in preparing labor schedules.
- Procured equipment and system components dictated by the facility designs and in congruence with labor schedules and project budgets.
- Performed surveying duties to ensure proper construction of the facility.

*Field Engineer & Estimator* — Jan. 2005 - Mar. 2006

Estimated project material and installation costs and worked alongside field electricians in planning and performing industrial-scale electrical and mechanical system installations

- Planned and performed the installation of electrical distribution equipment as part of a project installing a new 13.8 kV distribution system on the Delaware Memorial Bridge.
- Installed motor controller equipment and an industrial relay system as part of a rehabilitation project updating the electrical and mechanical systems of the South Market Street bascule bridge in Wilmington, DE.
- Procured equipment and system components dictated by the facility designs and in congruence with labor schedules and project budgets.
- Estimated installation costs of industrial electrical systems for preparing multimillion dollar construction project bids.

## Other Experiences

**Black Box Design, RMR Productions, Sasquatch Music Festival**, USA

*Production & Technical Assistant* — June 2008 - Jan. 2014

Performed production and technical duties including stage management, sound and lighting equipment operation, and equipment rigging for several large-scale and musical, theatrical, and festival events.

**"Vacuity" Film Crew**, Bozeman, MT, USA

*Electrical Engineer* — Spring 2012

Designed and constructed electrical components for the set of the science-fiction short film.

## Affiliations

Member, Institute of Electrical and Electronics Engineers (IEEE)
Member, Tau Beta Pi Engineering Honors Society

## Leadership & Service

| | |
|---|---|
| Technical Session Chair, *2017 IEEE Sensors Application Symposium* | March 13-15, 2017 |
| Reviewer, *IEEE Transaction on Energy Conversion* | 2009 – Present |
| Reviewer, *IEEE Transaction on Instrumentation & Measurement* | 2010 – Present |
| Reviewer, *Energy Efficiency* | Oct. 2015 – Present |
| Reviewer, *IEEE Sensors Journal* | Jan. 2016 – Present |
| Treasurer & Committee Member, Postdoc Initiative Grant Committee, *MIT* | April 2015 – Oct. 2015 |
| Steering Committee Board Member, *Bozeman Climate Alliance*, Bozeman, MT | June 2012 – Jan. 2013 |
| Performing Arts Coordinators / Music Committee Head, *Sweet Pea Festival of the Arts*, Bozeman, MT | Nov. 2008 – Nov. 2010 |

## Honors

Benjamin Fellowship, Montana State University
Syracuse University Dean's Scholar
Syracuse University Dean's List
Association of Old Crows Educational Foundation Chesapeake Bay Roost Scholar
Athletic Director's Honor Roll, Syracuse University
Men's Varsity Soccer, Syracuse University

## Journal Publications

[Under Review] **P. Lindahl**, D. Green, G. Bredariol, A. Aboulian, J. Donnal, J. Nation, S. Leeb. "A Non-intrusive Load Monitoring Framework for Shipboard Fault Detection." Submitted to *IEEE Transactions on Instrumentation & Measurement*.

[Under Review] **P. Lindahl**, S. Leeb, S. Shaw. "Fuel Cell Stack Emulation for Cell and Hardware-in-the-Loop Studies." Submitted to *IEEE Transactions on Instrumentation & Measurement*.

[In Press] **P. Lindahl**, G. Bredariol, J. Donnal, S. Leeb. "Noncontact Electrical System Monitoring on a US Coast Guard Cutter." Accepted to *IEEE Instrumentation & Measurement Magazine*.

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.

**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.

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. J. Cooley, **P. Lindahl**, C.L. Zimmerman, M. Cornachione, G. Jordan, S. R. Shaw, S. B. 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, S. R. 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. R. 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.

L. M. Hayden, A. M. Sinyukov, M. R. 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 Part B: Polymer Physics*. Vol. 41, pp. 2492-2500. Nov. 2003.

## Conference Publications

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. "Non-intrusive Monitoring for Shipboard Fault Detection." *2017 IEEE Sensors Applications Symposium*. March 2017.

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

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 2017*. Feb. 2017.

**P. Lindahl***, G. Bredariol, J. Donnal, S. Leeb. "Non-contact Sensors and Nonintrusive Load Monitoring (NILM) Aboard the USCGC SPENCER." *IEEE AUTOTESTCON 2016*. Sept., 2016.

** Denotes conference presenter*

## Conference Publications Continued

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.

G. Bredariol*, J. Donnal, **P. Lindahl**, S. B. Leeb, "Automatic Watchstander Through NILM Monitoring." *ASNE Day 2016*. Mar. 2016.

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

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

** Denotes conference presenter*

## Poster Presentations

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

## Co-Supervised Students

Daisy Hikari Green. Ph.D. Candidate, Electrical Engineering — Sept. 2016 – Present
Project topic: *Nonintrusive electrical and magnetic sensing for sustainability applications*
Co-Advisor: Dr. Steven B. Leeb

ENS Spencer Shabshab, M.S. Candidate, Electrical Engineering — July 2016 – Present
Project topic: *Improving microgrid efficiencies through coordinated HVAC control*
Co-Advisor: Dr. Steven B. Leeb

Andre Aboulian, M.S. Candidate, Electrical Engineering — June 2016 – Present
Project topic: *Sensor and network development for nonintrusive load monitoring (NILM)*
Co-Advisors: Dr. Steven B. Leeb, Dr. John Donnal

Manuel Gutierrez, Ph.D. Candidate, Electrical Engineering — July 2015 – Present
Project topic: *Multi-source converters for stability of grid-connected constant-power loads*
Co-Advisor: Dr. Steven B. Leeb, Dr. Arijit Banerjee

LT Greg Bredariol, M.S. Candidate, Mechanical Engineering — July 2015 – Present
Project topic: *Automated energy management using nonintrusive load monitors*
Co-Advisors: Dr. Steven B. Leeb, Dr. John Donnal

Joshua Nation, Ph.D. Candidate, Mechanical Engineering — Aug. 2014 – Present
Project topic: *Electrical and vibrational-based diagnostics of electromechanical systems*
Co-Advisor: Dr. Steven B. Leeb

Grant Gunnison, Undergraduate Researcher, Electrical Engineering — Aug. 2015 – May 2016
Project topic: *Utilizing heat capacity of U.S. Army tent structures for short-term energy storage*
Co-Advisors: Dr. Steven B. Leeb, Dr. John Donnal

LT Ryan Zachar, Naval Engineer, M.S. Engineering & Management — July 2014 – June 2015
Thesis: *Naval applications of enhanced temperature, vibration and power monitoring*
Co-Advisors: Dr. Steven B. Leeb, Dr. John Donnal

LT William Cotta, M.S. Mechanical Engineering — July 2014 – June 2015
Thesis: *Machinery diagnostics and characterization through electrical sensing*
Co-Advisors: Dr. Steven B. Leeb, Dr. John Donnal