

PRIMARY RESEARCH OBJECTIVES

Through my collaborative research activities, I seek to develop

1. computationally efficient **inverse problem** solvers for emerging power system applications;
2. rigorous yet practical **optimization & control** strategies for increasing renewable energy penetration;
3. analytical & **machine learning** based energy function solutions for **stabilizing** complex network systems.

EDUCATION

- **Massachusetts Institute of Technology (MIT)** Cambridge, MA
Doctor of Philosophy (PhD) in Mechanical Engineering (Power Systems) Aug. 2016 - Present
 - **Thesis:** *Inference, Estimation, and Prediction for Stable Operation of Modern Electric Power Systems*
 - **Committee:** Luca Daniel (advisor), Themis Sapsis (chair), Kotysta Turitsyn, Steve Leeb, Petr Vorobev
- **University of Vermont (UVM)** Burlington, VT
Master of Science (MS) in Electrical Engineering June 2015 - Aug. 2016
 - **Thesis:** *Using Real Time Statistical Data to Improve Voltage Stability in Stochastic Power Systems*
 - **Committee:** Paul Hines (advisor), Taras Lakoba (chair), Mads Almassalkhi
- **University of Vermont (UVM)** Burlington, VT
Bachelor of Science (BS) in Electrical Engineering Aug. 2011 - June 2015
 - Graduated *Magna Cum Laude* with 3.94/4.00 GPA; Minor in *Mathematics*

SELECTED PROFESSIONAL APPOINTMENTS AND ACTIVITIES

- **Computational Prototyping Group** Cambridge, MA
Graduate Research Assistant in the Electrical Engineering & Comp. Sci. Department at MIT Jan. 2019 - Present
 - Advised by Dr. Luca Daniel
 - Studied numerical simulation, inverse problem theory, and applied linear algebra
 - Developed advanced power system state estimation and dynamical inference solvers
 - Applied uncertainty quantification techniques for enhanced operation of power systems
- **Energy, Controls and Mechanics Research Nexus Group** Cambridge, MA
Graduate Research Assistant in the Mechanical Engineering Department at MIT Aug. 2016 - Dec. 2018
 - Advised by Dr. Kostya Turitsyn
 - Studied control theory, system dynamics, and applied optimization
 - Investigated the propagation of forced oscillations in electrical power system networks
 - Derived a forced oscillation source location solver using Bayesian inversion
 - Characterized the stability of various energy networks (e.g. natural gas pipeline systems, microgrids) using novel simulation and energy function analysis techniques
- **Energy and Complexity Research Group** Burlington, VT
Under/Graduate Research Assistant in the Electrical Engineering Department at UVM Jan 2014 - Aug. 2016
 - Advised by Dr. Paul Hines
 - Explored the statistical warning signs of voltage instability in transmission networks
 - Constructed a reactive power controller which used PMU data statistics as a feedback signal
 - Performed data sanitation and organization in a DOE-sponsored demand response study
- **Graduate and Undergraduate Teaching Assistant (TA)** Burlington, VT
Instructor for Electrical Engineering Labs at UVM 2014 - 2016
 - EE81: Linear Circuits 1 (1x)
 - EE113: Introduction to Electrical Energy Systems (3x)

• Graduate Resident Advisor (GRA)

Cambridge, MA

Mentor for Undergraduates at MIT

Aug. 2017 - Present

- Supported 40 undergraduate students as a live-in resource on a residential hall
- Resolved interpersonal conflict, built community, and acted as a mental health resource

• LORD Microstrain

Williston, VT

Electrical Engineering Intern

Summer 2013 and 2014

- Developed software in LabVIEW for calibrating wireless sensor nodes and networks
- Performed sensor prototype assembly and subsequent wireless packet transmission testing

• Academic Reviewer

2015-Present

- IEEE Transactions on Power Systems
- IEEE Transactions on Smart Grid
- IEEE Power and Energy Society General Meeting (PESGM)
- IEEE Power Engineering Letters
- IET Generation, Transmission & Distribution
- American Control Conference (ACC)

RELEVANT SKILLS

- **Programming Tools:** MATLAB (expert), Python, Julia, C, PowerWorld, Power System Analysis Toolbox (PSAT), MATPower, LabVIEW, PSpice, Arduino, LaTeX, PSS/E (novice)
- **Mathematical Tools:** linear algebra, differential equations, inverse problem theory, Bayesian inversion, power system and circuit analysis, applied optimization, control theory, mechanical dynamics, electromagnetics, model order reduction, numerical simulation, statistics, stochastic processes, uncertainty quantification
- **Interpersonal Skills:** Strong written and oral communication skills; active listening skills; trained in Restorative Practices (RP); extensive coaching and mentoring experiences in a diversity of contexts

HONORS AND AWARDS

- ★ America East Presidential Scholar Recipient (2015)
- ★ Senior Electrical Engineering Award: Atwater-Kent Award for Excellence of Judgment and Understanding of the Principles of Electrical Engineering (2015)
- ★ Tau Beta Pi Honor Society Inductee (2014)
- ★ American Public Power Association Scholarship (2014)
- ★ Recipient of the Richard A. Swenson Endowed Scholarship (2013 - 2014)
- ★ Sophomore Electrical Engineering Award: Excellence and Greatest Promise (2013)
- ★ Recipient of the Vermont Scholar's Award Scholarship (2011-2014)

SELECTED PUBLICATIONS

1. T. Bradde, M. De Stefano, **S. Chevalier**, L. Daniel, and S. Grivet-Talocia, "Real Time Vector Fitting." Under preparation for submission to IEEE Transactions on Power Systems.
2. **S. Chevalier**, K. Turitsyn, L. Daniel, and P. Vorobev, "Stability Certification Standards for DC Microgrid Networks with Arbitrary Load Configurations." Under preparation for submission to IEEE Transactions on Power Systems.
3. **S. Chevalier**, L. Schenato, and L. Daniel, "Probabilistic Power Flow in Distribution Networks via Model Reduction and Neumann Expansion." Under preparation for submission to IEEE Transactions on Power Systems.
4. **S. Chevalier** and D. Wu, "Dynamic Linepack Depletion Models for Natural Gas Pipeline Networks." Submitted to Applied Mathematical Modeling (January 2020). *Under Review*.
5. A. Mikhalev, A. Emchinov, **S. Chevalier**, Y. Maximov and Petr Vorobev, "A Bayesian Framework for Power System Components Identification." Accepted at the PESGM 2020.
6. **S. Chevalier**, P. Vorobev and K. Turitsyn, "A Passivity Interpretation of Energy-Based Forced Oscillation Source Location Methods," in IEEE Transactions on Power Systems, vol. 35, no. 5, pp. 3588-3602, Sept. 2020, doi: 10.1109/TPWRS.2020.2973070.
7. D. Wu, P. Vorobev, **S. Chevalier** and K. Turitsyn, "Modulated Oscillations of Synchronous Machine Nonlinear Dynamics With Saturation," in IEEE Transactions on Power Systems, vol. 35, no. 4, pp. 2915-2925, July 2020, doi: 10.1109/TPWRS.2019.2958707.

8. **S. Chevalier**, P. Vorobev, K. Turitsyn, B. Wang and S. Maslennikov, "Using Passivity Theory to Interpret the Dissipating Energy Flow Method," 2019 IEEE Power & Energy Society General Meeting (PESGM), Atlanta, GA, USA, 2019, pp. 1-5, doi: 10.1109/PESGM40551.2019.8974116.
9. P. Vorobev, **S. Chevalier** and K. Turitsyn, "Decentralized stability rules for microgrids," 2019 American Control Conference (ACC), Philadelphia, PA, USA, 2019, pp. 2596-2601, doi: 10.23919/ACC.2019.8815214.
10. **S. Chevalier**, P. Vorobev and K. Turitsyn, "A Bayesian Approach to Forced Oscillation Source Location Given Uncertain Generator Parameters," in IEEE Transactions on Power Systems, vol. 34, no. 2, pp. 1641-1649, March 2019, doi: 10.1109/TPWRS.2018.2879222.
11. **S. Chevalier**, P. Vorobev and K. Turitsyn, "Using Effective Generator Impedance for Forced Oscillation Source Location," in IEEE Transactions on Power Systems, vol. 33, no. 6, pp. 6264-6277, Nov. 2018, doi: 10.1109/TPWRS.2018.2834229.
12. **S. Chevalier** and P. D. H. Hines, "Mitigating the Risk of Voltage Collapse Using Statistical Measures From PMU Data," in IEEE Transactions on Power Systems, vol. 34, no. 1, pp. 120-128, Jan. 2019, doi: 10.1109/TPWRS.2018.2866484.
13. **S. Chevalier** and P. D. H. Hines, "Identifying system-wide early warning signs of instability in stochastic power systems," 2016 IEEE Power and Energy Society General Meeting (PESGM), Boston, MA, 2016, pp. 1-5, doi: 10.1109/PESGM.2016.7741815.