

Dr. Yilu LiuE-mail: Liu@utk.edu Cell (865) 266 3597

Personal Data: U.S. Citizen**EDUCATION**

PhD EE The Ohio State University, Columbus OH, Dec. 1989, Advisor: Stephen A. Sebo
MS EE The Ohio State University, Columbus OH, Dec. 1985, Advisor: Stephen A. Sebo
BS EE Xian Jiaotong University, Xian, China, July 1982.

AWARDS AND HONORS

2021 R&D 100 Award Winner Award, IT/Electrical Category, “Grid Damper” (m-UGA)
IEEE Power & Energy Society Wanda Reder Pioneer in Power Award, 2020.
Excellent Paper Award “Build Smart Grids on Big Data and Artificial Intelligence – a Real-world Example,”
Workshop on AI in Power and Energy Systems, September 4th, 2020 AIPES Organizing Committee, ECAI
2020.
Best student paper in the IAS I&CPS Asia 2020 for “Advanced Synchrophasor- Based Application for Potential
Distributed Energy Resources Management: Key Technology, Challenge and Vision”, 2020.
IEEE PES General Meeting Best Paper Session for “Data Quality Analysis and Solutions for Distribution-Level
PMUs”, 2019
2019 CSEE JPES 3rd prize award “A Hybrid Dynamic Demand Control Strategy for Power System Frequency
Regulation”
R&D 100 award, “Mobile Universal Grid Analyzer (m-UGA), 2018
Award for Translational Research, Tickle College of Engineering, 2018
Distinguished Alumina Award, 2017, The Ohio State University, 2017
Award of Excellent Paper in Energy Forum together with Zhiyong Yuan and Jiuping Pan, 2017
National Academy of Inventors, 2017
National Academy of Engineering, 2016
Gonzalez Award for Research Excellence, University of Tennessee, Knoxville, EECS Department, 2015.
Three (3) Best Conference Papers Awards at IEEE PES 2015 General Meeting, 2015.
R&D 100 Finalist for “Universal Grid Monitoring and Analyzing System (UGMAS)”, 2015.
R&D 100 Award, “A Magnetic Solution to Power Flow” Continuously Variable Series Reactor, 2014
Dean’s Award for Research Excellence, 2005, Virginia Tech.
Fellow of IEEE, 2003.
Presidential Faculty Fellow named by President Bill Clinton, NSF, 1994
Young Investigator Award, NSF, 1993
Dean’s list for top teachers in the College of Engineering for 12 years (1997-2000, 2002-2009), Virginia Tech

ACADEMIC EXPERIENCE

Governor’s Chair	University of Tennessee, 2009-present
<u>Professor</u>	Department of Electrical Engineering, Virginia Tech, 2001-2009
<u>Associate Professor</u>	Department of Electrical Engineering, Virginia Tech, 1996-2001
<u>Assistant Professor</u>	Department of Electrical Engineering, Virginia Tech, 1990-1996.
<u>Director</u>	Center for Power Engineering, Virginia Tech, 2004-2009
<u>Director</u>	FNET/PowerIT Lab, Developed and Operates the North America Power Grid Monitoring Network, 2003-2009

NATIONAL LAB EXPERIENCE

Governor’s Chair Oak Ridge National Laboratory, 2009-present

Graduate students and Post Drs. Advised:

Graduated over 48 PhD and 42 MS students. Advised over 48 post Dr.
Currently advising 15 PhD students, and 15 post Dr. scholars

Students Awards:

PhD Advisee, Wenxiun Yao received the outstanding Student of the Year, 2018 NASPI Awards.
PhD Advisee, Ellen Wu, Jeff Zhao received the outstanding Student of the Year, 2017 NASPI Awards.
PhD Advisee, Eric Zhan, received the outstanding Student of the Year, 2015 NASPI Awards.
PhD Advisee, Micah Till, received the outstanding Student of the Year, 2014 NASPI Awards.

Courses taught:

Introduction to power engineering, Power quality, Wide area measurements applications in power, FACTS/Energy storage system in power, Power system dynamics and PSS/E tool, Power system transients and PSCAD tool.

INDUSTRIAL EXPERIENCE

Application Engineer General Electric Co., HV Transmission Research Center (EPRI), Lenox MA, Summer 1993.
High Voltage Lab Engineer Xian Jiaotong University, Xian, China, 1983-1984.

PROFESSIONAL ACTIVITIES AND SERVICES

IEEE Smart Grid Synchronized Measurements and Analytics (SGSMA) conference Steering Committee
National Academy of Engineering Section 6 Search Committee, Vice Chair
National Academy of Engineering TNC Committee member
IEEE PES Fellows committee member
IEEE Fellow committee member
Editorial board of European Transactions on Electrical Power
Editorial board, IEEE Transactions on Smart Grid
Editorial board of the Journal of Modern Power Systems and Clean Energy, published by SpringerOpen
Reviewer for IEEE Transactions and other Journals, about 40 papers/year
Reviewer for NSF, DOE, DOD, USID proposals, 20+ proposals/year.
Bonneville Power Administration Technology Innovation Proposal Reviewer.
Editorial board of Springer Journal on Intelligent Systems
Editor Elsevier Publishing Phasor Measurement Units and Wide Area Monitoring Systems: from the sensors to the system by Antonello Monti, Carlo Muscas and Ferdinanda Ponci.
Editorial board of IEEE proceedings
Editor for IEEE Access Board
Guest Editor of Electrification Magazine – December 2015 issue.
Guest editor, special issue on “Wide-area Synchronous Data for Grid Management”, Proceedings IEEE, 2016.
CIGRE USNC Executive Committee
Reviewer for the 2015 Department of Defense SMART Scholarship Evaluation Panel
Members of IEEE Power and Energy, Industry Applications, Power Electronics Society
Chairman of Membership Development Committee, IEEE VM Section
Member of several IEEE/PES T&D working groups
Numerous session chairs of professional meetings and conferences.
Invited reviewer, Wayne State University academic program review, ECE Department, 2005.
Member of CSEE Editorial Board of Journal of Power and Energy Systems
Chair of Advisory Committee of the 5th International Conference on Electric Utility Deregulation and Restructuring and Power Technologies (DRPT2015)
Reviewer for Bonneville Power Administration (BPA) Technology Innovation Office.
Editorial board member of High Voltage Science & Technology journal

Editorial board member for IEEE Transactions on Sustainable Energy towards a special edition on Power system Protection surrounding Renewable Energy Systems.
Editorial Board for a Special Issue of IEEE Trans. on Power Systems: Wind Power Integration into Future Power Systems
IEEE Public Visibility Committee
GTD Editorial Board Member
Selection Committee of the IFAC Industrial Achievement Award
Organizing Committee Member for the 6th Global Congress and Expo on Applied Science and Engineering (AppScience-2021), Lisbon, Portugal, April 22-23, 2021.
IET Generation, Transmission & Distribution Board Members.
Search Committee for the ESTD Associate Lab Director 2020
Review committee for the track Modeling and Simulation for Smart Energy Systems (MSSES) at ANNSIM 2021
Reviewer for the National Academies draft report, *Powering the U.S. Army of the Future*
CIGRE USNC Executive Committee, 2022 - 2024

Service to the Department, College, and University

COE Dean's search committee
JICS Search committee
CIRE Committee
Associate Dean search committee
Tenure and Promotion Committee
Faculty Executive Committee/Faculty Advisory Committee
Award Committee
Dean's Department Head Search Committee
University Honor Court Faculty Member
University Faculty Senate

PUBLICATIONS:

Patents:

1. Robert Gardner, Zhian Zhong, Yilu Liu "Location Determination of Power System Disturbances Based on Frequency Responses of the System," United States **Patent 7519454**, April 14, 2009.
2. "Accurate Magnetic Field Sensor and Method For Wireless Phasor Measurements Unit," Zhang et al., US Patent Application Publication, Pub. No: US 2010/0250168 A1, Pub. Date: Sept. 30, 2010.
3. "Sensor, Method and System of Monitoring Transmission Lines," Syracuse et al., US Patent Application Publication, Pub. No: US 2009/0284249 A1, Pub. Date: Nov. 19, 2009.
4. Robert Matthew Gardner, Zhian Zhong, Yilu Liu, "Location determination of power system disturbances based on frequency responses of the system." **US Patent 7765034**, Jul, 27 2010.
5. G. Zhang, Y. Liu, Y. Zhang, "Accurate Magnetic Field Sensor and Method for Wireless Phasor Measurement Unit," **US Patent 8437969**, May 7, 2013.
6. Yilu Liu; Robert Matthew Gardner; Zhian Zhong "Location Determination of Power System Disturbances Based on Frequency Responses of the System," **Canada Patent: 2,634,583**, 10/6/2015.
7. Yilu Liu, Lingwei Zhang, "Universal Grid Analyzer", Full Utility Patent, **Patent Issued 3/24/20, U.S. Patent No. 10,598,704, Serial 14/802,307.**
8. Liu, Y. (2021). *Timestamp inconsistency and shift detection for Synchrophasor Data Based on correlation between relative phase angle and frequency.* **US Patent No. 16,418,540.**

Patents Pending:

9. Tao Xia, Yilu Liu, "Sample-Weighted Sinusoidal Phase Angle Error Reduction in Discrete Fourier Transform in Digital Signal Processing," **US Provisional Patent No. 61892643**, 2013.
10. "Location Determination of Power System Disturbances Based on Frequency Responses of the System," Inventors: Robert Gardner, Zhian Zhong, Yilu Liu, Europe Patent Application No. 06838659, August, 2008.

11. S. Fernandez, M. Shankar, J. Nutaro, Y. Liu, A. Dimitrovski, O. Omitaomu, C. Groer, K. Spafford, R. Vatsavai, "Real-Time Simulation of Power Grid Disruption", U.S. PTO Provisional Patent Application 61/589,419, July 2015.
12. Lingwei Zhan, Wenxuan Yao, Yilu Liu, Wei Gao, Haoyang Lu, "Mobile Platform Phasor Measurement Unit Based On Electric Field Sensor," Full Utility Patent pending, 2015.
13. Fangxing Li, Hantao Cui, AhmadzadehRaji Mohamad, Kevin Tomsovic, Yilu Liu, Jian Huang, "A distributed data streaming server (D2S2) software package for power system real-time simulation", Full Utility Patent pending, 2016.
14. You, Liu, Wu, Zhou, Ye, "Power Grid Disturbance Locating Based on the Rate of Change of Frequency," UTRF PD 16082, Full Utility Patent pending, 2016.
15. Yao, Wenxuan; Zhao, Jiecheng; Cui, Yi; Liu, Yilu, "Magnetic field based Wireless GMD/EMP-E3 Impact Monitoring Device," full utility patent pending, 2016, 15/349,779.
16. Jidong 'Jack' Chai, Yilu Liu, Wenxuan Yao, Jiecheng 'Jeff' Zhao, "TAMPERING DETECTION AND LOCATION IDENTIFICATION OF DIGITAL AUDIO RECORDINGS [CURENT]," 14/992,974, US Patent Filed 1/11/2016
17. Yi Cui; Feifei Bai; Wenxuan Yao; Yong Liu; Ling Wu; Yilu Liu, "Power Disturbance Localization Based on Hybrid Computational Intelligence," New US Patent Application No. **15/609,861**, Filed: May 31, 2017.
18. Wenxuan Yao; Jiecheng Zhao; Yilu Liu; Andrew N. Herron; Daniel J. King; Thomas J. King, Jr.; Lingwei Zhang "Ultra-Fast Synchronized Measurement Algorithms for Power System Fast Situational Awareness" New US Patent Application No. **15/609,484**, Filed: May 31, 2017.
19. Provisional patent on "Pulser Array for power grid precision timing" filed June, 2018,
20. Yilu Liu, Wenxuan Yao, Lingwei Zhan, Wei Gao, Haoyang Lu, "Mobile Electric Field Sensor Based Phasor Measurement Unit for Monitoring an Electric Power Grid," US Patent 10,024,897 B2, July 17, 2018.
21. Xianda Deng, Yilu Liu, Wenpeng Yu, Zhihao Jiang, Lakshmi Sundaresh, "Real-Time Co-Simulation of Multiple Transient Stability Software for Large Power System Model [CURENT]," Patent Application Filed; Appln 62/849,565; UTRF 19154-03; Legal 1306/117 PROV.
22. Fangxing Li, Hantao Cui, MohammadReza AhmadzadehRaji, Kevin Louis Tomsovic, Yilu Liu, and Jian Huang. "Real-time simulator and controller of power system using distributed data streaming server", **U.S. Patent Issued 10/20/20, No. 10809753.**
23. Dingrui Li, Yilu Liu, Yiwei Ma, Ishita Ray, Leon Tolbert, Fred (Fei) Wang, He (Henry) Yin, Lin Zhu, "METHODS, SYSTEMS, AND COMPUTER READABLE MEDIA FOR PROTECTING AND CONTROLLING A MICROGRID WITH A DYNAMIC BOUNDARY [CURENT]," US Patent Filed 1/29/2020, 16/775,836
24. Yilu Liu, Lingwei Zhan, Wenxuan Yao, "Universal Grid Analyzer," U.S. Patent, US 10,598,704, March 24, 2020.
25. You S, Zhou D, Wu L, Liu Y, "Power system disturbance location determination based on rate of change of frequency," Patent number: 10372148. Filed date: 16 Nov 2016. Awarded date: 06 Aug 2019. Publication date: 06 Aug 2019.
26. Peter Fuhr, Thomas King, Yilu Liu, Yong Liu, Marisa Morales, Wenxuan Yao, He (Henry) Yin, Lingwei (Eric) Zhan, Jiecheng 'Jeff' Zhao, "PULSAR BASED TIMING SYNCHRONIZATION METHOD AND SYSTEM [CURENT]," US Patent Filed 4/29/2019, 16/397,687.
27. Yilu Liu, Yiwei Ma, Xiaojie Shi, Leon Tolbert, Fred (Fei) Wang, Lin Zhu, "MICROGRIDS WITH DYNAMICALLY CONFIGURABLE BOUNDARIES INCLUDING MULTIPLE MAIN GRID FEEDER COUPLING LOCATIONS AND METHODS OF OPERATING THE SAME [CURENT]" US Patent 10447038, Issued 10/15/19.
28. Cui Y, Bai F, Yao W, Liu Y, Wu L, Liu Y, "Power system disturbance localization using recurrence quantification analysis and minimum-volume-enclosing ellipsoid," Patent number: 10371740. Filed date: 31 May 2017. Awarded date: 06 Aug 2019. Publication date: 06 Aug 2019.
29. Yao W, Zhao J, Liu Y, Herron A, King D, King T, Zhan L, "Synchrophasor measurement method for power systems," Patent number: 10191094. Publication date: 29 Jan 2019.
30. Yilu Liu, Wenxuan Yao, Wenpeng Yu, "TIMESTAMP INCONSISTENCY AND SHIFT DETECTION FOR SYNCHROPHASOR DATA BASED ON CORRELATION BETWEEN RELATIVE PHASE ANGLE AND FREQUENCY [CURENT]," US Patent Filed 5/21/2019, 16/418,540.
31. Lingwei Zhan, Bailu Xiao, Thomas King Jr, Wenxuan Yao, Henry Yin, Yilu Liu, Fuhua Li, "A fault-tolerant grid frequency estimation method during transient," Ser. No./Pat. No. 63/010,863, 4/16/2020. Patent License.

32. Yi Cui, Yilu Liu, Yong Liu, "POWER SYSTEM INERTIA ESTIMATION USING SYNCHROPHASOR FREQUENCY MEASUREMENTS [CURENT]," US Patent 10884042, Issued 1/5/2021.
33. Yilu Liu, Ling Wu, Wenpeng Yu, "POWER SYSTEM DETECTION OF SUSTAINED OSCILLATIONS BASED ON SYNCHROPHASOR FREQUENCY MEASUREMENTS [CURENT]," US Patent 10948527, Issued 3/16/2021.
34. J. Chai, Yilu Liu, J. Zhao, et al. Tampering detection and location identification of digital audio recordings: U.S. Patent Application 14/992,974(P). Application granted: 2021-07-20. US11069370B2.
35. F. Li, H. Cui, M R AhmadzadehRaji, K. Tomsovic, Yilu Liu, et al. Real-time simulator and controller of power system using distributed data streaming server: U.S. Patent 10,809,753(P). Application granted: 2020-10-20. US10809753B2.
36. Yilu Liu, R. Gardner, Y. Wu. Systems and methods for solar energy-based computation: U.S. Patent Application 16/946,521(P). Publication: 2020-12-31. US20200409234A1.
37. F. Wang, D. Li, Yilu Liu, et al. Methods, systems, and computer readable media for protecting and controlling a microgrid with a dynamic boundary: U.S. Patent Application 16/775,836(P). Publication: 2020-11-5. US20200371143A1.
38. L. Zhan, B. Xiao, H. Yin, F. Li, W. Yao, Z. Li, T. King, Yilu Liu. Apparatus, methods and computer-readable medium for efficient electrical grid measurements: U. S. Patent Application 16/744,805(P). Publication 2021-7-29. US20210231716A1.
39. Yilu Liu, Y.U. Wenpeng, W. Yao. Timestamp inconsistency and shift detection for synchrophasor data based on correlation between relative phase angle and frequency. U.S. Patent Application 16/418,540(P). Publication: 2020-11-26. US20200371143A1.
40. Yilu Liu, joint invention with ORNL and Brixon. A scalable Control System for Networked Community-Based Microgrids with Dynamic Boundary. Social Media and Synesthesia Steganography as a Command and Control Protocol for Offensive Cyber Frameworks: U.S. Patent Application 21013-03-B01. Date Received: 2020-07-13

Books and Book Chapters:

1. IEEE Press Book (CD ROM version) on Harmonic Modeling, 1999.
2. Contributor to the "Comprehensive Dictionary of Electrical Engineering" CRC Press, 1999.
3. "Handbook of Electric Power Calculations," chapter on Transformers, 2000.
4. IEEE Tutorial chapter on "Nonlinear Magnetic Saturation Modeling", 1998.
5. Wiley book chapter on smart grids.
6. Yong Liu; Joe R. Gracia; Thomas J. King; Yilu Liu, Large Scale Renewable Power Generation: Advances in Technologies for Generation, Transmission and Storage by Springer (Extended abstract accepted), Book chapter to be published on GridCloud-Killer apps.
7. SPRINGER-VERLAG-Smart Power Grids Electric power systems, chapter on "Synchronized phasor measurement in Smart grid situational awareness."
8. Liu, Yilu, et al. "Synchronized phasor measurement in Smart grid situational awareness," Power Grids Electric Power Systems, Springer-Verlag-Smart, 2014
9. Liu, Yong; Yilu Liu, "SGD029: Wide Area Monitoring Through Phasor Measurement Units (PMUs)" Accepted for publication, Handbook of Smart Grid Development, September 2015.
10. Guest Editor of Special Issue on GIC Impact to Power Grid for the "Electrification Magazine". Dec. Issue, 2015.
11. Guest editor of the IEEE Proceedings special issue on Wide Area Phasor Measurement Technology, 2016.
12. Yilu Liu, Yong Liu, Ye Zhang, Jiahui Guo, Dao Zhou, "Wide Area Monitoring Through Synchrophasor Measurement," in the Smart Grid Handbook, UK: John Wiley & Sons, Ltd, pp. 163-180.
13. Yong Liu, Yilu Liu, "The IET book on Smart Grids," The Print ISBN is: 978-1-78561-142-1, The Ebook ISBN is: 978-1-78561-143-8, 2, 2016.
14. Weikang Wang, Kaiqi Sun, Chujie Zeng, Chang Chen, Wei Qiu, Yilu Liu, "Wide-area Power Systems Stability, Protection, and Security," Springer, 2020. Print ISBN 978-3-030-54274-0, Online ISBN 978-3-030-54275-7
15. "REAL-TIME SIMULATOR AND CONTROLLER OF POWER SYSTEM USING DISTRIBUTED DATA STREAMING SERVER" (UTRF disclosure 17019) October 20, 2020, Patent No. 10,809,753.
16. Lingwei Zhan et al, "Apparatus, methods and computer-readable medium for efficient electrical grid measurements," US Patent and Trademark Office, Application 16/744,805, January 5, 2021.

17. S. You, Y. Su, Y. Liu, Yilu Liu. Wide-area monitoring and anomaly analysis based on synchrophasor measurement(M)/New Technologies for Power System Operation and Analysis. Academic Press, 2021: 143-161.

Invention Disclosures:

1. Low Voltage Frequency Measurement Improvement, VTIP:05.029
2. Use Wide Area Measurement Parameters for Power Grid Transmission and Distribution Line Activity and Their Location Estimation, VTIP:07-112
3. Use of Frequency Properties to Improve Event Location Estimation in Power System, VTIP:07-069
4. A Methodology for Determining the Location of Events in Power Grid based on Frequency Measurements and Grid Dynamic Simulations, VTIP:07-074
5. Invention disclosure 201002433, titled “Massively Parallel Field Programmable Analog Array for Power Grid Control.” ORNL, 2010.
6. Invention disclosure, titled “Fast Elements,” ORNL. 2010.
7. One power system dynamic response estimation method, Inventors: Yong Liu, Yilu Liu, Kai Sun
8. UPS/ Backup Generation Detection in Power System Based on Frequency Monitoring Network(FNET), Inventors: Jiahui Guo, Yanzhu Ye, Yilu Liu, Patrick Willging
9. Tampering Detection in Digital Recordings Using Electric Network Frequency and Phase Angle Investors: Jidong Chai, Yilu Liu
10. Angle-based TDOA Method for Event Location Estimation on Wide-area Frequency Measurements, Inventors: Yanzhu Ye, Yilu Liu.
11. Invention Disclosure: 201002433, Title: “Massively Parallel Field Programmable Analog Array for Power Grid Control.” Date of Disclosure: July 26, 2010, ORNL.
12. Invention Disclosure: 201002459, Title: “Real-Time Simulation of Power Grid Disruptions”, Date of Disclosure: July 26. 2010
13. Oscillation-aided Event Location Estimation Method on Wide-area Frequency Measurements, Inventors: Yanzhu Ye, Yilu Liu, Ye Zhang
14. Transfer Function Dynamic Model Development of Power Grids Based on Ambient Data Measurement, Inventor: Hesun Liu, Yong Liu, Yilu Liu
15. Measurement Based Power System Dynamics Prediction with Multivariate Autoregressive Model, Inventors: Changgang Li, Yilu Liu.
16. Hesun Liu; Yong Liu; Yilu Liu, A power system dynamic response estimation method based on ambient data, 2013.
17. “Apparatus and Method for Synchronous Sampling with a Variable Sampling Rate”, Lingwei Zhan, Yilu Liu,
18. A new method to evaluate power system angle stability with high order derivatives of angle dynamics, Inventors: Changgang Li, Yilu Liu
19. A New Method to Reduce Sinusoidal Error of Angle and Frequency Estimation in Single Phase Power System Measurement, Inventors: Lingwei Zhan, Yilu Liu
20. A power system dynamic response estimation method, Inventors: Yong Liu, Yilu Liu, Kai Sun
21. UPS/Backup Generation detection in power system based on Frequency Monitoring Network(FNET), Inventors: Jiahui Guo, Yanzhu Ye, Yilu Liu, Patrick Willging.
22. A Power System Dynamic Response Estimation Method Based on Ambient Data. Inventors: Yilu Liu, Hesun Liu, Yong Liu
23. Measurement Based Power system Dynamics Prediction with Multivariate Autoregressive Model. Inventors: Yilu Liu, Changgang Li
24. Sample-weighted sinusoidal angle error reduction DFT. Inventors: Yilu Liu
25. Transfer Function Dynamic Model Development of Power Grids Based on Ambient Data Measurement. Inventors: Hesun Liu, Yong Liu, Yilu Liu.
26. Oscillation-aided Event Location Estimation Method on Wide-area Frequency Measurements, Inventors: Yanzhu Ye, Yilu Liu
27. Angle-based TDOA Method for Event Location Estimation on Wide-area Frequency Measurements, Inventors: Yanzhu Ye, Yilu Liu, Ye Zhang.
28. Power Disturbance Localization Based on Hybrid Computational Intelligence Techniques, Inventors: Yi Cui, Yilu Liu. April 2017.

29. "A Microgrid With Multiple Utility Feeders and Dynamic Boundaries," Inventors: Yilu Liu et al.
30. Invention Disclosure 201703908, "A Measurement-based Power System Dynamic Model Reduction Method," Inventors: Yaosuo Xue, Yilu Liu, Xuemei Zhang, April 2017.
31. Invention Disclosure UTRF 18114-03, "Wide-area damping control design using measurement-driven approach," Contributors: Evangelos Farantatos, Yilu Liu, Yi Zhao, Lin Zhu, Nov 2017.
32. Invention Disclosure, "A Scalable Controller for Community-Based Microgrid with Dynamic Boundary", Fred Wang, Yilu Liu, et al., September 2020.
33. "Universal Grid Analyzer and New High-Speed High-Accuracy Measurement Method for Power Grids to DigiCollect LLC" Licensed by UTRF, October 2020.
34. "A Fault-Tolerant Grid Frequency Estimation Method During Transients" Yilu Liu, He Yin, Fuhua Li, January 2021 Filed.
35. "Social Media and Synesthesia Steganography as a Command and Control Protocol for Offensive Cyber Frameworks" Fuhr, Peter; Liu, Yilu; et. al. Invention Disclosure ID# : 202004644, DOE S# S-162,058.

Papers in refereed journals and special publications:

1. R. Caldecott, Y. Liu, S.A. Sebo, D. G. Kasten, "Measurement of the Frequency Dependent Impedance of Major HVDC Converter Station Equipment," *IEEE Trans. on Power Delivery*, Vol. 5, No. 1, January, 1990, pp. 474-480, 7 pages.
2. Y. Liu, S.A. Sebo, R. Caldecott, D.G. Kasten, "Power Transformer Resonance -- Measurements and Prediction," *IEEE Trans. on Power Delivery*, Vol. 7, No.1, Jan. 1992, pp.245-253, 7 pages.
3. Y. Liu, S.A. Sebo, R. Caldecott, D.G. Kasten, "Modeling of Converter Transformer Using Frequency Domain Terminal Impedance Measurements," *IEEE Transactions on PWRD*, Vol. 8, No.1, January 1993, pp. 66-72, 7 pages.
4. S. Lu*, Y. Liu, "FEM Analysis of Transformer DC Magnetization under the Influence of Geomagnetically Induced Currents," *IEEE Transactions On PWRD*, Vol. 8, No.3, July 1993, pp. 1367-1374, 8 pages.
5. S. Lu*, J. DeLaRee, Y. Liu, "Harmonics Generated from a DC Biased Transformer," *IEEE Trans. PWRD*, Vol.8, No.2, April 1993, 7 pages.
6. S. Lu*, Y. Liu, "Modeling of Power Transformer Excitation Under GIC/SMD Based on 3D Finite Element Analysis," *International Journal of Power and Energy Systems*, Vol.13, No.2, pp. 37-41, 1993, 5 pages.
7. D. G. Kasten, R. Caldecott, S.A. Sebo, Y. Liu, "A Computer Program for HVDC Converter Station RF Noise Calculations," *IEEE Transactions on PWRD*, Vol. 9, No. 2, April 1993, pp.750-756, 7 pages.
8. Y. Liu, H. Meng*, S. A. Sebo. D.G. Kasten, R. Caldecott, "Transformer Transient Responses Prediction," *International Journal of Power and Energy Systems*, Vol. 15, No. 1, 1995, 8 pages.
9. S. Lu*, Y. Liu, "Harmonics from DC Biased Three-Phase Transformer Banks," *International Journal of Energy Systems*, Vol 17, Nov. 2, 1997. 7 pages.
10. Y. Liu, L. Zaffanella, "Calculation of Electric Field and Audible Noise From Transmission Lines of Non-parallel Conductors," *IEEE Transactions on PWRD*, Vol. 11, No. 3, July 1996, 6 pages.
11. Y. Zhang*, X. Ding*, Y. Liu, P. Griffin, "ANN Based Transformer Diagnoses Using Gas-in-oil Analysis," 96 WM 225-3 PWRD, *IEEE Trans. PWRD*, Vol. 11, No. 4, Oct.,1996, 6 pages.
12. S. Lu*, Y. Liu, "Modeling of Power Transformer Operation Under GIC/SMD", *International Journal of Power and Energy Systems*, Vol. 17. No. 1, 1997, 7 pages.
13. J. Hess*, C. Richard*, H. Brown*, D. Smith*, Y. Liu "Computer Animations in Undergraduate Education," *IEEE Computer Applications in Power*, January, 1998, pp.31-36, 6 pages.
14. "Test Systems for Harmonics Modeling and Simulation" by Task Force on Harmonics Modeling and Simulation, Transmission & Distribution Committee, IEEE Power Engineering Society, *IEEE Transactions*, Vol: 14, No. 2, page(s): 579-587, April 1999.
15. W. Xu, Y. Liu "Excel Based Harmonic Load Flow Analysis Program", IEEE/PES *Computer Application in Power*, Vol. 12, No. 1, January, 1999, pp.41-45, 5 pages.
16. Z. Wang*, Y. Liu, P. Griffin, "A Combined ANN and Expert System Tool for Transformer Fault Diagnosis," *IEEE Trans. PWRD*, 1998, 6 pages.
17. W. Xu and Y. Liu, "Series Load Flow - A Novel Non-Iterative Load Flow Solution Method," *IEE Proceedings*, T&D, Vol. 145, No. 3, May 1998, pp.251-256, 6 pages.
18. Z. Wang*, D. Zhu, k. Tan, F. Li, Y. Liu "PD Monitor System for Power Generators", *IEEE Transactions On Dielectrics and Electrical Insulation*, Vol. 5, No. 6, December 1998, pp.850-856, 7 pages.

19. X. Dong*, D. Zhu, C. Wang, K. Tan, Y. Liu "Simulation of transformer PD pulse propagation and monitoring for a 500 kV substation", *IEEE Transaction on Dielectrics and Electrical Insulation*, Vol. 6, pp. 803-813, December 1999, 11 pages.
20. S. Lu*, Y. Liu, W. Xu "Integration of Power Transformer Research into Undergraduate Education", *International Journal of Power and Energy systems*, Vol. 19, No. 3, 1999, pp. 224-230, 7 pages.
21. W. Xu, Hermann, W. Dommel, M. Brent Hughes, Yilu Liu, John C. Salmon, "Modelling of DC Drives for Power System Harmonic Analysis", *IEE Proceedings*, Gener. Transm. Distrib., Vol. 146, No. 3, May 1999, pp. 217-222, 6 pages.
22. Aysen Arsoy*, Zhenyuan Wang*, Yilu Liu, Paulo Ribeiro, "Transient Modeling and Simulation of a SMES Coil and the Power Electronics Interface", *IEEE Transaction on Applied Superconductivity*, Vol.9, No. 4, December 1999. pp. 4715-4724, 10 pages.
23. Z. Wang*, Y. Liu, P. Griffin "Neural Net and Expert System Diagnose Transformer Faults", IEEE/PES *Computer Application in Power*, Vol. 13, No. 1, January, 2000, pp.50-55, 6 pages.
24. Z. Wang*, Y. Liu, "Modeling and Simulation of a Cycloconverter Drive System for Harmonic Studies," *IEEE Trans. on Industry Electronics*, Vol. 47, No. 3, June 2000, pp.533-541, 9 pages.
25. W. Xu, X. Liu, Y. Liu, "Assessment of Harmonic Resonance Potential for Shunt Capacitor Applications," accepted for publication in the *Electric Power Systems Research Journal*, 2000, 7 pages.
26. W. Xu, Y. Liu, "A Method of determining customer and utility harmonic contributions at the place of common coupling," *IEEE Trans. on Power Delivery*, Vol. 15, No.2, April 2000, pp. 804-811, 8 pages.
27. Invited paper, P. Ribeiro, B. Johnson, M. Crow, A. Arsoy*, Y. Liu "Energy Storage Systems for Advanced Power Applications", *IEEE Proceedings*, Vol 89, number 12, pp. 1744-1756, December 2001.
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SPONSORED RESEARCH

Total personal funding over \$ 17.5 million, jointly with other PIs over \$42 million

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2. "High Frequency Transformer Terminal Models and its Application to EMTP," supported by the Creative Match Grants, Virginia Tech. Principal Investigator, 7/1991-7/1992.
3. "Transformer Magnetization Under the Influence of Geomagnetically Induced Currents, Phase II" National Science Foundation. Principal Investigator, 8/1991-1/1993.
4. "Fiber Optic Temperature Sensing for Cast-Type Power Transformers," supported by ABB, Co-PI with Murphy, 8/1991-8/1992.

5. "Enhanced Out-of-Step Relaying," Florida Power & Light Co., Co-PI with Phadke and DeLaRee, 1/1991-12/1992.
6. "Modern Power System Simulation Laboratory," Taiwan Power Co., Co-PI with Tam, DeLaRee, Phadke, 1/1990-12/1992.
7. "Improving Power System Dynamic Performance with Synchronized Phasor Measurements through GPS Satellite," EPRI/FPL/GA, Co-PI with Phadke and DeLaRee, 8/1991-8/1994.
8. "Transformer Magnetization Under the Influence of Geomagnetically Induced Currents," funded by NSF for REU, Principal Investigator.
9. "Transformer On-line Monitoring System and Failure Prediction," TVA, 1993, Co-PI with Claus, Murphy.
10. "GE Summer Faculty Internship", GE/National Science Foundation, summer 1993, Principal Investigator.
11. Young Investigator's Award (NYI), "Power Quality and Power System Harmonics, NSF, PI, Aug. 1993-1998.
12. "Reliability Analysis of Fiber Optic By-pass Switch" FiberCom, Roanoke, VA, Co-PI with Murphy, Clause, Guthrie, Aug. 1994-Nov. 1994.
13. "Generator Protection Analysis using EMTP," GE Drive Systems, Salem, VA, Co-PI with Phadke, Sept. 1994-May 1995.
14. Presidential Faculty Fellow (PFF), "Equipment Failure Diagnosis through Adaptive Pattern Recognition," NSF, PI, Aug. 1994-1999.
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20. GOALI: EMTDC Simulations for SMES Coil Transient Analysis, NSF and BWX Technologies, 1998, PI.
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25. "Harmonics and Reactive Power Calculations for GIC Saturated Transformers," National Grid, UK/Metatech, PI, 1999.
26. "Fiber Optic Sensor Based Transformer Partial Discharge Detection-Phase II", EPRI, Co-PI with Anbo Wang, 2000.
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28. "Investigation of Effect on Internal Insulation of Main Transformers In Mingtan Operation Environment", Taiwan Power Company, PI, 2000.
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47. "FDR Development for EDF", EDF, France, PI, 8/1/07-3/12/08, PI.
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50. "Integration of Virginia Tech FNET Frequency Data into NERC-FMA," DOE/LBNL, 3/2008-8/2009, PI.
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55. "Power Grid Situation Awareness Using FNET," PSRC (PJM, AEP, First Energy, NY-ISO, ISO-NE) 2007-2011, PI.
56. "Resilient and Sustainable Interdependent Electric Power and Communications Systems," NSF (EFRI), SP, Lamine Mili is the PI, 2008-2012.
57. FNET Consortium Membership, 10 power utilities plus FERC and NERC, 2008-2014, PI.
58. "Transformer GIC Study" for Dominion Virginia Power, via VTF, 2008-2009.
59. FNET Research, Dominion Virginia Power, via VTF, 2008-2014.
60. FNET Research, Integrys Energy Service, via VTF, 2009.
61. Equipment fund to purchase AC source for FNET Research, AEP, via VTF, 2009.
62. "Power Grid Situation Awareness Using FNET" Project extension, RPI, 8/2009- 7/2010, PI (awarded, paper work in progress).
63. "ABB Smart Grid Research: ABB, via VTF, 2009 .
64. "Corona Mitigation Study", Dominion Virginia Power, via VTF, 2009.
65. "Integrate Event Location Algorithm to TVA Super PDC", EPRI, 2009.
66. FNET Research, TVA, 2009-2014.
67. Fundamental Research to Improve the Understanding of the Accuracy, Reliability, and Validity of Using the ENF Criterion for Forensic Auth. of Dig. Rec, VT/NIJ, 11,2009.
68. Transformer Model Study, ABB, 2/2010.
69. Integration of FNET Frequency Data into NERC-FMA, LBNL, 11/2009.
70. GridEye Development, ORNL, 2009- 2010.
71. OTEC Power System Stability Study, Lockheed Martin, 12/31/2010.
72. Enhancement and Integration of Location of Disturbance, EPRI, 10/11/2010.
73. Data Driven Power System Modeling Study, ABB, 9/2010.
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75. Electric Field Sensor Based Voltage Phasor Measurement Unit, EPRI, 2/2010.
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77. Cyber Enabled Power Grids, RPI, 6, 2011.
78. NSF/DOE ERC " Ultra-wide-area resilient electric power networks", 8/ 2011.
79. Governor's Chair, DOE, UT-Battelle, ORNL, 2010-2014.
80. "ERC for Ultra-Wide", NSF, 2011-2013.
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84. "GIL Fellowship," DOE, UT-Battelle, ORNL, 2011
85. "NERC Frequency Response Initiative," DOE, UT-Battelle, ORNL, 2011.
86. "Wide-Area Measurement Data Driven Model for Stability Analysis-II", EPRI, 2013.
87. "High-performance Hybrid Simulation/Measurement- Based Tools", EPRI, 2013.
88. "Integration of FNET Frequency Data into NERC-FMA", Lawrence Berkely Nat'l Lab, 2012-2013.
89. "2030 BAU dynamic model development; NIST round robin PMU text, Impact of PMU error, physical security
90. "ORNL membership- Gov. Chair Research Fund," ORNL, 2013.
91. "Dynamic Model and Wind for Power Grid Control," ORNL, 2013.
92. "Modeling DVP HVAC Power Grid in RTDs," DVP, 2013.
93. "EI reduced model DG integration RTDS Modeling," ABB, 2013.
94. "Add-on to CURENT Data Analytics and Architecture Workshops," DOE, 2013.
95. "Oscillation damping control development using transfer function model," EPRI, 2013.
96. "Yilu Liu Research Fund," UT Batelle, 2013

97. "CPS: Synergy: Achieving High- Resolution Situational Awareness," NSF, 2012.
98. Simulations, DVP physical security review," ORNL, 2014.
99. "GIC Harmonic Calculations, PMU Test, Data Integration Effort", DVP, 2014.
100. TVA, ABB focused research fund, 2014.
101. FNET events and oscillation alerts to CURENT industry members, FNET Consortium members, 2011-2015.
102. "Using Measurement-based Approach to Model, Predict and Control Large-scale Power Grids," NSF, 2015.
103. "Supporting ORNL in Grid Modeling and Measurement Technology," UT-Battelle, 2014-2015.
104. CURENT industry focus research, TVA, EPRI, ORNL, ABB, Southern, Dominion, 2015.
105. CURENT 2015 research
106. "Supporting ORNL Research", UT-Battelle, 2015-2016,
107. Sunlamp research award, DOE Sunshot program, 2015,
108. Extreme event, UT-Battelle, 2016-2018,
109. EMP Modeling, UT-Battelle, 2016-2018.
110. Spare Transformer Modleing, UT-Battelle, 2016.
111. Advanced sensor development, UT-Battelle, 2016-2018.
112. CURENT industry focus research, TVA, EPRI, ORNL, ABB, Southern, Dominion, 2016.
113. CURENT 2016 research
114. BPA Power System Stability Study, ABB, 2016
115. NYPA Oscillation damping control, EPRI, 2016
116. NYPA Oscillation damping control demo on HTP, EPRI, 2017,
117. Itlay grid oscillation damping control, EPRI, 2017.
118. Flexbile transformer design, ABB/DOE, 2017
119. Sensor placement for distribution grid, GMLC. 2017, 2018.
120. NYPA Oscillation damping control demo on HTP, EPRI, 2018
121. CURENT industry focus research, TVA, EPRI, ORNL, ABB, Southern, Dominion, GeiriNA, Raytheon, 2017, 2018.
122. CURENT 2017, 2018 research
123. Saudi grid oscillation damping control, EPRI, 2018.
124. NSF Eager Award, 2018.
125. DOE CHP Award, 2018, co-PI
126. Load modeling, DOE/ORNL, 2018
127. Minimum frequency response reserve, D/ORNL 2018.
128. DOE support of NERC Operations, DOE/ORNL, 2018
129. Advancaed Sensor algorithm demonstration, DOE/ORNL, 2018
130. Fast Sensor algorithm development, DOE/ORNL, 2018
131. SETO Smart Inverter control for frequency response, DOE/ORNL, 2018
132. NREL Grid Continuous simulation, MIDAS, DOE/NREL, 2018.
133. NERC support for grid situational awareness, DOE/ORNL, 2019.
134. Multi-timescale Integrated Dynamics and Scheduling for Solar (MIDAS-Solar), DOE/NREL, 2019.
135. Fault Tolerant Frequency Estimation for Power Grid, DOE/NREL, 2019.
136. Sensor Deployment and Sever Development For Puerto Rico Electric Power Authority (PREPA) Grid, DOE/ORNL, 2019.
137. Cybersecurity II, DOE/ORNL, 2019.
138. CPS: Small: Data-driven Real-time Data Authentication in Wide-Area Energy Infrastructure Sensor Networks, NSF, 2019.
139. MRI: Development of Pulsar-based Power Grid Timing Instrumentation and Technology, NSF, 2019.
140. Integration of power system Wide Area Monitoring Systems (WAMS) measurements over a given time period that may be spatially and temporally unique due to the unique characteristics of specific substation, DOE/ORNL, 2019
141. TERN Phase II, EPRI, 2019.
142. Frequency and Phase Algorithms and Phasor Measurement Survey, DOE/ORNL, 2020.
143. Forced Oscillation Source Location and Mitigation Using Energy Storage Systems and Inverter Based Renewables, EPRI, 2020.
144. Next Generation Grid Monitoring and Control - Decentralized and Hierarchical Controls - HIL Implementiom, EPRI, 2020.
145. Wide Area Monitoring System Using FNET/GridEye-Saudi Electricity Company, EPRI 2020.

146. Mitigating low-frequency oscillations in large-scale electric power systems using an adaptive and dependable measurement-driven controller, NSF, 2020.
147. Adaptive Power Oscillation Damping Control via HVDC/FACTS Devices Using Measurement-Driven Model for Great Britain Power Grid, EPRI 2020.
148. Expansion on a decentralized data architecture, DOE/ORNL, 2020.

RESEARCH INTERESTS:

Power system wide area monitoring and control
Interconnection scale steady and dynamic simulations
Power equipment modeling and diagnosis
FACTS and energy storage applications in power system oscillation damping and wind farm regulation
Distribution system monitoring for DG and smart grid applications
Power quality and power system harmonics
Electrical Transients and high voltage engineering

TEACHING INTERESTS:

Power system dynamics modeling and simulations, PSS/E
Wide area measurement and control in power systems
Power quality and power system harmonics
Power equipment modeling
Power system transients PSCAD
Electric circuit analysis
Electric machines
High voltage engineering