Thomas E. McDermott, Ph.D., PE, LFIEEE **Expert in Renewable Energy and Smart Grids**
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Education and Training

• Rensselaer Polytechnic Institute, Troy, NY	Electric Power Engineering	B.S., 1980
• Rensselaer Polytechnic Institute, Troy, NY	Electric Power Engineering	M. Eng., 1981
• Virginia Tech, Blacksburg, VA	Electrical Engineering	Ph.D., 1998

Licenses

• Registered Professional Engineer	Commonwealth of Pennsylvania	# PE035275-E
• Registered Professional Engineer	Commonwealth of Virginia	# 0402065874

Research and Professional Experience

Meltran, Inc. **President, 2024-present**
Continued part-time consulting in power system standards development and electromagnetic transient modeling for inverter-based resources. Leading IEEE P1729 and supporting the NERC EMT Task Force.

Thomas Jefferson Foundation **Monticello Guide, 2024-present**
Part-time job conducting tours of Monticello, interpreting the legacies of Thomas Jefferson, slavery in the United States, and founding principles of the United States.

Pacific Northwest National Laboratory **Chief Engineer, Solar Subsector Lead, 2016-2023**
Responsible for technical thought leadership and project management for the Laboratory's research portfolio in distribution analysis and automation, demand response, and distributed energy technologies. The primary focus was on novel simulation, modelling, and analysis capabilities. Led National Lab support of the DOE Interconnection Innovation e-Xchange (i2X) project, which aims to reduce the time and cost of renewable integration while maintaining grid reliability. Other projects involved system protection, transactive energy system simulation, data standards for GridAPPS-D, improved cyber security for rural electric cooperatives, grid-forming inverter modeling and battery storage system integration on distribution circuits. Was also responsible for PNNL's business strategy and relationships with the DOE Solar Energy Technologies Office. Started with the title of Chief Engineer in August 2016. Added responsibility as Solar Subsector Lead in May 2018. Retired in September 2023.

University of Pittsburgh **Assistant Professor, 2012-2016**
Responsible for a funded research program in electric power systems, teaching undergraduate and graduate courses, and advising graduate students. Taught eight courses. Developed three courses and new lab content. Primary advisor or co-advisor for three Ph.D. students.

MelTran, Inc. **President and Founder, 2009-2016, 2023-present**
Formed a Pennsylvania S Corporation and developed a consulting practice in electric power systems that continuously produced fully loaded gross billings by the principal. Managed independent contractors, negotiated contracts, conducted marketing and technical outreach activity, administered the insurance and financial aspects of the business. Served 19 different clients over a 4-year period, many of them are repeat customers. See www.meltran.com for more details. Started with title of President in April 2009.

EnerNex, Inc. **Sr. Consulting Engineer, 2004-2009**
Principal investigator for two DoE SBIR projects in electric power distribution systems. Developed UWIG software tools for distributed wind applications and presented wind integration seminars. Principal investigator for two EPRI projects on advanced distribution feeder design. Performed many electromagnetic transient and harmonic studies for ISO New England, Northeast Utilities, United Illuminating, NSTAR, National Grid, American Transmission Company, LIPA/KeySpan, PacifiCorp, Alliant, Oak Ridge Energy, PacifiCorp, Florida Power & Light, and others. Wrote proposals and papers; made presentations. Started with title of Consulting Engineer in October 2004. Promoted to Sr. Consulting Engineer in December 2006.

Ansoft, Inc. **Senior R&D Engineer, 2002-2004**

Developed a cross-platform, co-simulation link between the Maxwell transient finite element solver and the SIMPLORER circuit simulation program. Implemented a new version of SPICE-compatible device models for SIMPLORER. Maintained interfaces to equivalent circuit models derived from finite element solutions. Added several component models and output probe functions to SIMPLORER. Wrote user documentation and application notes; made presentations. Started with the title of Senior Research and Development Engineer in February 2002.

Electrotek Concepts, Inc. **Project Engineer, 1997-2002**

Lead developer for several EPRI software projects; power quality planning software for distribution systems, lightning surge analysis in customer facilities, lightning protection of overhead distribution lines, and transient analysis of substations. Developed a totally new version of the company's Web-based software for viewing power quality data. Enhanced the company's harmonic analysis and waveform post-processing software. Wrote papers and used EPRI contacts to obtain work in new areas for the company. Started with the title of Senior Power Systems Engineer in April 1997. Promoted to Project Engineer in April 1999.

Ansoft, Inc. **Development Engineer, 1994-1997**

Developed schematic capture and waveform calculator software on Windows and Motif platforms. Maintained SPICE and Saber interfaces. Project engineer for the Electromechanical System Simulator (EMSS), as advertised on inside back cover of IEEE Spectrum. Enhanced the 2D field simulator and post processor. Wrote articles, papers, and application notes. Made presentations. Started with the title of Development Engineer in April 1994.

Power Technologies, Inc. **Senior Engineer, 1988-1994**

Project Engineer for the EPRI Lightning Protection Design Workstation (versions 1 and 2), and for initial work on the Substation Design Workstation. Provided studies, field tests, and other consulting services to a variety of companies. Taught short courses, wrote proposals and reports, published articles, demonstrated software, conducted meetings, and supervised other engineers assigned to projects. Consistently exceeded annual applied time targets. Started with the title of Analytical Engineer in May 1988. Promoted to Senior Engineer in August 1990.

Westinghouse Electric **Senior Engineer, 1981-1988**

Conducted digital computer studies and field tests of transients on power systems. Developed custom data acquisition and analysis software for both long-term monitoring and staged field tests of transients and harmonics. Taught a 3-credit probability and statistics course for Penn State-McKeesport as part of the Westinghouse Advanced School in Power Systems Engineering. Started with the title of Associate Engineer in June 1981. Promoted to Engineer in July 1982 and Senior Engineer B in September 1983.

American Electric Power **Co-op Engineer 1978-1980**

Completed coop rotations in electrical substation projects, transmission planning, special studies and protective relaying at the AEP Service Corporation in New York City. Completed a summer assignment in relay verification engineering at the D. C. Cook Nuclear Plant in Michigan. Held title of Co-op Engineer from August-December 1978, from May-August 1979 and from June-August 1980.

Honors and Awards

1. IEEE PES Award for Excellence in Power Distribution Engineering, May 2021, "for contributions to simulation techniques for power distribution systems, including integration of distributed energy resources and modeling lightning transients".
2. IEEE Fellow, January 2014, "for contributions to modeling and analysis of electric power distribution systems and lightning protection".
3. IEEE PES Pittsburgh Chapter Outstanding Engineer Award, May 2013
4. IEEE Distinguished Service Award, Power System Analysis, Computing and Economics Committee, 2010

5. IEEE Standards Board Award for IEEE Std. 1410 - IEEE Guide for Improving the Lightning Performance of Electric Power Overhead Distribution Lines, 2004
6. IEEE Working Group Award, Radial Test Feeders, 2003
7. IEEE Industry Applications Magazine Prize Article, 2002
8. IEEE Third Millennium Medal, 2000
9. Westinghouse Engineering Achievement Award, 1984
10. IEEE Fortescue Fellowship, 1980-1981
11. NSF Graduate Research Fellowship, 1980 (declined)
12. James Wynant Williams Prize at Rensselaer, 1980

Synergistic Activities

1. IEEE Power and Energy Society, Industry Applications Society, Standards Association.
2. Chair of IEEE P1729 Working Group, Recommended Practice for Electric Power Distribution System Analysis.
3. NERC Electromagnetic Transients (EMT) Task Force, work item 3 co-chair.
4. Open-Source Software – administering and contributing to several open-source software packages:
   a. OpenDSS (https://sourceforge.net/projects/electricdss/)
   b. OpenETran (https://github.com/MAB522/OpenETran)
   c. IEEE Flash (https://sourceforge.net/projects/ieeeflash/)
   d. KLUSolve (https://sourceforge.net/projects/klusolve/)
   e. CIMHub (https://github.com/GRIDAPPSD/CIMHub/tree/feature/SETO)
   f. DPVProt (https://github.com/pnnl/dpvprot)
   g. PECBlocks (https://github.com/pnnl/pecblocks)
   h. GridHub (https://github.com/temcdrm/gridhub)
   i. EMTHub™ (https://github.com/temcdrm/emthub)
   j. i2X tools for IBR modeling (https://github.com/pnnl/i2x/tree/develop)
   k. NERC/i2X EMT Bootcamp Materials (https://github.com/pnnl/i2x/tree/master/emt-bootcamp)
5. Member of IEC 61968 CIM/CDPSM modeling team – drafted unbalanced model profiles for distribution, participated in the first CDPSM interoperability tests, was U.S. lead for IEC TC57 WG13.
6. Adjunct Professor at University of Pittsburgh – co-advised four graduate students.
7. IEEE/PES WG on Distributed Resource Integration (past Chair)
8. IEEE/PES WG on Wind & Solar Power Plants, System Impacts, and Interconnection Requirements (past Chair)
9. IEEE/PES Distribution System Analysis Subcommittee (past Chair)
10. IEEE/PES WG on the Lightning Performance of Overhead Lines (past task force leader)
11. IEEE/PES WG on Estimating the Lightning Performance of Transmission Lines (past Chair)
12. IEEE P1547.8 WG developing a Recommended Practice for High Penetration of Distributed Resources (past writing group leader, ballot resolution team)
13. IEEE/PES Power System Analysis, Computing, and Economics Committee (past Standards Representative)
14. Pittsburgh Section IEEE (past Chair, Treasurer for 2008 General Power Meeting)
15. Cigre WG C4.502 on "Power System Technical Performance Issues Related to the Application of Long HVAC Cables" (past task force leader)

Research Project Experience

Interconnection Innovation Exchange (i2X) (2021-2023) – This project is a collaboration of three DOE national labs with the DOE Solar and Wind Energy Technologies Offices, under the Bipartisan Infrastructure Law (BIL), to make wind and solar interconnections faster, simpler, and fairer, while maintaining or improving grid reliability. Interconnection times have doubled since 2015, which jeopardizes economic growth and decarbonization. Tom is managing PNNL's contribution to i2X as the lead lab. This includes a 5-year roadmap to improve the queue-based process, supported by "sprint studies" to demonstrate improvements to the current queue-based process, and an auction-based

alternative to the queue process. Sprint studies are based on open-source tools and public test systems. The i2X data portal design includes various energy equity metrics, utility-scale distributed energy resources (DER), and census tract data to fill gaps in existing report formats to measure improvement. Interconnection studies guides for DER and bulk power system (BPS) renewables are under development. Technical assistance (TA) projects to state regulators and other interconnection process stakeholders are planned to begin in January 2023. See https://energy.gov/i2x and https://github.com/pnnl/i2x/tree/develop for more details.

Essential Grid Operations for Solar (EOS) (2021-2023) – This project is a collaboration of 3 DOE national labs to support development of IEEE Standards 1547.x, 1729, and 2800.x for grid integration of solar generation. A task lead under Tom's technical supervision supports P2800.2 subgroup 3 in model-based conformance assessment of inverter-based resource (IBR) plants, including comparison of real-code and generic EMT models. (IBR includes solar, storage, and most wind generation). This required the negotiation of technical support from an IBR vendor under very restrictive non-disclosure conditions. Tom also leads the revision of IEEE 1729 to include methods for determining DER hosting capacity and perform dynamic analysis on the distribution grid.

Common Information Model for Electromagnetic Transients (CIM-for-EMT) (2021-2023) – This is a Technology Commercialization Fund (TCF) project to demonstrate the use of CIM, an international standard, to efficiently build large-scale simulation models of the electric grid with IBR. Tom designed the universal modeling language (UML) diagrams for CIM implementation of the smart inverter functions in IEEE Standard 1547-2018, and for unbalanced transmission lines. The development team is implementing scripts that translate models from power flow tools, e.g., PSSE and PSLF, to CIM and then to EMTP®, a commercial transient simulation program. Tom designed the software architecture and module interfaces, test systems, and scenarios to verify correct simulation results.

Open Energy Data Initiative (OEDI) (2021-2023) – This project is a collaboration of four DOE national labs to develop a library of data and algorithms to support research in grid integration of distributed solar generation. Tom designed and developed software that produces transient models of distribution feeders from CIM. He wrote code that simulates faults on systems with many IBR on the system, providing data for machine learning algorithms and imputed phasor measurement unit (PMU) data. Tom also wrote code that simulates load, generation, and voltage fluctuations driven by weather and residential thermostats on the library feeders at a 5-second time step. This provides data for imputed Supervisory Control and Data Acquisition (SCADA) system data. Researchers use library feeders, and the imputed data, to test and validate their own numerical algorithms. Tom developed documentation and tutorials on the platform, and delivered training sessions to five universities. Task leaders under his supervision provided sample code for state estimator and optimal power flow algorithms. In the project's second year, Tom will develop sample code that aggregates distributed IBR from imputed transient data.

Grid-Forming Inverter Control (2020-2023) – The scope is to develop efficient and accurate nonlinear and dynamic block diagram models of power electronic inverters for black-start and control design. Tom implemented transient inverter models and a hardware testbed to produce waveform data. He developed Python code to run simulations, fit the block diagram parameters from 80% of the waveforms, and use 20% of the waveforms to test the accuracy. These models meet a normalized root mean square error metric ≤ 0.02, and are suited for training from EMT simulation or lab test data. Tom implemented the block diagram models in ATP and the HELICS co-simulation framework.

MS-SPEAK (2018-2023) – The scope is to improve cybersecurity of MultiSpeak, a software interoperability protocol used by rural electric cooperatives, which have limited IT resources. Tom directed the development of a cybersecurity reference architecture, which included recommendations for MultiSpeak updates and best practices, along with specifications for a custom intrusion detection system (IDS). He directed the development of this IDS, set up a virtual test platform in the cloud, wrote the documentation, and made a public video tutorial for using the IDS.

Distribution System Research Roadmap (2020-2022) – Tom led a three-lab project to develop a roadmap for DOE Energy Efficiency and Renewable Energy (EERE) research technology integration with the distribution grid. The roadmap was designed to synergize with projects funded by the DOE Office of Electricity (OE). It suggested projects to fill specific gaps, and to improve the delivery of research results to industry. A technology integration platform was proposed, for which each EERE technology office could provide a reference model for grid integration of their technology. Feedback was incorporated from EPRI and NRECA.

Byzantine Fault Tolerance for Bulk Power System Relays (2020-2022) – The scope was to improve cybersecurity of protective relays on large power transformers. Tom defined a substation test system, specified algorithms in a software defined relay, set up the model in ATP, prototyped the algorithm in Python, and educated computer science team members in power system protection. He guided the development of a situational awareness module, in Xyce and C/C++, running in real time on CentOs.

Transactive Microgrid (2017-2022) – The scope was to demonstrate a campus grid with two batteries, two solar generators and two buildings with responsive load, in off-grid and grid-service modes. Tom provided advice to Avista on system design and smart inverter requirements, prototyped the grid test system in TESP and Python, implemented a consensus market mechanism in Python, and developed preliminary test plans for Avista and the WSU campus facilities department.

GridAPPS-D (2016-2021) – This project develops an open-source platform for distributed software applications in the electric power system, reducing the cost of deploying advanced applications. Tom supervised the interoperability task team, including three staff and a subcontractor. He also contributed to the IEC working groups for standards 61868 and 61970, the Common Information Model (CIM). Tom contributed CIM data structures for distributed energy resources (DER), multi-circuit lines, and catalog datasheets. He developed the software component that manages CIM files, adds measurements, and launches real-time simulations.

Protection of Feeders with Distributed Photovoltaics (2018-2021) – The scope was to solve DER protection issues posed by the new ride-through requirements in IEEE Standard 1547. Tom simulated incremental distance protection and a data-driven scheme on two utility feeders with high solar generation. He specified the field installation of relays to monitor but not trip at two solar DER sites (Chattanooga Electric Power Board and Dominion Energy Virginia), and analyzed their waveform data to verify correct performance. He implemented an incremental distance algorithm in Python and changed the setting procedure to suit inverter-based DER on distribution. The incremental distance algorithm was also implemented in OpenDSS.

Transactive Energy Simulation Platform (TESP) (2016-2020) – TESP is an open-source tool for collaborative research into new methods of managing electric power through market-based constructs. Tom directed a team ranging from 4-6 developers. He designed the TESP architecture to link several domain simulators (MATPOWER, PYPOWER, AMES, GridLAB-D, EnergyPlus, OpenDSS) with customizable transactive software agents, to configure and monitor simulations, and to analyze results. He designed and implemented messaging schemas, post-processing tools and scenario configuration tools.

Cybersecurity of Distance Relays (2018-2019) – The scope was to answer questions from DOE on whether to disable the communication links to distance relays, to improve their cybersecurity. Tom wrote a report that identified the risks of slowing down relay functions. He tested relay protection schemes with loss of communications on a miniature power system. The final report recommended that engineering access could be restricted, but not peer-to-peer communication.

Protection System Research Roadmap (2016-2018) – Tom co-authored a research roadmap for the DOE Office of Electricity, including the effect of bi-directional power flow on distribution systems. He simulated focused directional and traveling wave protection schemes using ATP, and determined they are not suitable for distribution circuits with DER. He also simulated incremental distance protection schemes and determined they could work on distribution circuits.

Consulting Project Experience

Qado Energy (2011 – 2016) – assisted in proposal preparation and then served as Scientific Advisor to execution of a DOE SUNSHOT Incubator grant.

National Grid (2006-2016) – worked in three main areas:

- Performed over twenty voltage control, flicker, islanding, and overcurrent protection studies for wind turbines and photovoltaic projects connected to distribution feeders. Developed cost estimates and prepared interconnection study results for delivery to applicants within the regulatory time frame of 55 business days. Helped National Grid develop anti-islanding and protection strategies for accommodating large amounts of distributed generation.
- Analyzed the transient recovery voltage (TRV) mitigation requirements and options for 13 capacitor banks with current-limiting reactors (CLR) located at 7 different substations (115-, 230-, and 345-kV) in New York and New England. Simulation results were provided to a circuit breaker vendor for product-specific TRV evaluation. Outrush current limiting, and the impact of cable contingencies, were also evaluated. Budget and schedule estimates were developed for TRV mitigation. Presented a webinar on TRV concerns.
- Evaluated 345-kV harmonic filter design for Sandy Pond High Voltage Direct Current (HVDC) terminal, intended to reduce background 5th-harmonic distortion that exceeded IEEE guidelines. Developed a harmonic load flow and frequency scan model of the nearby system, calibrated with harmonic voltage and current measurements, including frequency-dependent X/R ratios in lines, transformers, and loads. All combinations of filter dispatch and single line/transformer contingency were evaluated for improved performance.

Keyes, Fox & Weidman LLP (2015) – provided expert testimony on a solar power net energy metering rate case before the Nevada Public Utility Commission.

Eversource (2015) Owner's engineer review of OSHA transient overvoltage bid specifications for live-line maintenance.

Ruby Farms Strathroy Solar (2013) – developed an Alternative Transients Program model of PV micro-inverters and a distribution feeder, calculated fault currents and voltages, produced simulation reports to verify PV interconnection settings for fault protection.

Taihan Electric (2013) – provided modelling support in forensic investigation of 345-kV cable failure.

Northeast Utilities (2004-2013) – Tom played a key role in this effort to perform extensive harmonic and transient analysis of the southwest Connecticut power system on behalf of ISO-New England and Northeast Utilities (the operating companies) to evaluate the maximum amount of underground 345-kV cable that could safely be used in a major expansion of that system. The analysis required running tens of thousands of cases and developing the automation systems to validate and process the results. Later, Tom conducted a feasibility study for ISO-New England on a proposed generator expansion in the area, which would involve additional 345-kV cable. Electromechanical dynamic models of these generators, including the excitation systems, were included in the TOV studies. Tom has conducted several other transient studies for Northeast Utilities:

- Effect of 345-kV cable installation on distribution feeder arrester applications
- 345-kV cable parameter sensitivity study on temporary overvoltages
- Study of temporary overvoltages on the 115-kV system in southwest Connecticut
- Study of transient recovery voltages associated with 115-kV cable installation
- Temporary overvoltage study of the proposed New England East-West Solutions (NEEWS) projects. Several design options were evaluated for 345-kV transmission paths in the Greater Springfield, Central Connecticut, and Interstate Reliability Projects, which are part of NEEWS.
- 345-kV circuit breaker requirements and switching surge mitigation for NEEWS.

- Current-limiting reactor TRV study at Breckwood 115-kV substation.
- Sensitivity study of Bethel-Norwalk TOV with one or two HPFF cables in service.

Each study has required the refinement and extension of automated methods to prepare ATP simulation models and to generate reports. These automated methods are essential for quality control and efficiency. The NEEWS project, in particular, has one of the most extensive and detailed models ever used in a study of electromagnetic transients.

EPRI (2009-2012) – performed several consulting studies for EPRI, in addition to the applied research projects and software development projects discussed elsewhere:

- Supported the IEC Distribution Common Information Model (DCIM) with gap analysis and interoperability testing. Developed models in the DCIM for distribution feeders provided by Southern Company and PacifiCorp. The scope included data translation from different commercial software products, a new DCIM export function from EPRI's OpenDSS software, and a gap analysis of new features required for the DCIM to adequately model North American distribution feeders. Participated on the IEC TC57 / WG14 modeling team developing the unbalanced Common Distribution Power System Model (CDPSM) profile in preparation for the first CDPSM interoperability tests in 2009. Provided test files and participated in the test at Oncor in Dallas. Continued to participate in the WG14 modeling team and used OpenDSS to participate on EPRI's behalf in the 2011 DCIM Interoperability Tests at EDF in Paris.
- Green Circuit and Plug-in Electric Vehicle (PEV) studies on the Con Edison secondary network. Converted two large secondary network distribution models to OpenDSS, and performed studies and assessments of loss reduction, and of PEV penetration limits. Planning of this system is driven by N-2 contingencies. The analysis of loss reduction and peak shaving methods is being extended to other large secondary networks. In another extension of the work, Automated Metering Infrastructure (AMI) requirements for state estimation and outage identification are being developed for secondary networks.

Dominion Virginia Power (2011-12) – assisting the client in evaluating overhead line trip-outs during thunderstorms and determining whether the lines are performing as expected. Developed a custom analysis tool (based on IEEE Flash) that uses Dominion line design data with lightning detection network data to efficiently evaluate these trip-outs. The project continued with analysis and documentation of several cases.

Sandia National Lab (2011) – converted feeder models from an electric utility into OpenDSS format and benchmarked the models against power flow solutions in the utility's commercial software package. Developed photovoltaic power and voltage fluctuation simulations for Sandia to use as the starting point for evaluating high-penetration scenarios.

Dynalectric (2010) – built a model and simulated transients caused by vacuum switching of dry and liquid transformers in a data center build-out. Resistor-capacitor (RC) snubber and surge arrester protection schemes were evaluated, and guidelines developed for future projects. This project required practical application and interpretation of IEEE proposed standard PC57.142, which was of great concern to the client.

Oak Ridge National Lab (2010) – evaluated the proposed grounding scheme for two new regulating autotransformers and performed a frequency scan of the facility power system. The system model was converted from SKM Captor to OpenDSS.

Southport Power (2011) – analyzed several wind and solar distributed generation project alternatives in Vermont, considering project size, technology, radial feeder, express feeder, and sub-transmission options. Southport used the study to help establish the most economically and technically feasible projects to apply for interconnection with the local utility.

SISCO Systems (2010) – prepared a white paper on modeling transformers in the IEC Common Information Model (CIM). Documented use cases, examples and schema modifications in the Unified Modeling Language (UML).

Coriolis Wind (2010) – market entry analysis for medium-sized wind turbines. Performed a conceptual wind interconnection design and cost estimates and provided a summary of U.S. interconnection requirements.

Energinet DK (2010) – performed a harmonic frequency scan analysis for the Rodsand 2 offshore wind plant.

American Transmission Company (2010) – performed a transformer inrush current mitigation study at 345 kV.

PacifiCorp (2009-2010) – harmonic analysis and training for a 46-kV industrial load, and insulation coordination for a 345-kV transmission line. Implemented and applied probabilistic line flashover rate calculations, using statistical EMTP outputs. Estimated flashover rates for the 345-kV line design at high altitude and with a series capacitor. Contamination flashover experience with other high-altitude lines was assessed.

Florida Power & Light (2009) – performed a transient study of capacitor switching and breaker failures at 230 kV. Recommended design changes to avoid future problems.

NSTAR Electric – Cable Switching Transient Studies (earlier career) Tom conducted an ATP study of dynamic overvoltages associated with proposed 345-kV cable installations at Stoughton substation in the Boston area. Efficient automated tools to produce ATP input files from ASPEN OneLiner files were developed. The study results included mitigation options that helped NSTAR secure project approval from ISO New England. Later, cable parameter sensitivity studies were conducted, and operating conditions for a Special Protection System (SPS) were specified. Low-side switching options were developed to mitigate TRVs when switching cables with shunt compensation, and cable commissioning test results were analyzed.

NSTAR Electric – Cape Wind Transient Study (earlier career) Tom conducted a frequency scan and switching transient study of the offshore Cape Wind project's interconnection to the 115-kV system on Cape Cod at Barnstable substation. The areas of investigation included cable energizing transients with Monte Carlo simulation, dynamic overvoltages associated with fault initiation and clearing, potential voltage magnification at lower voltage cable installations, and transient recovery voltages in open-air and gas-insulated substations. The study results helped NSTAR secure project approval from ISO New England.

NSTAR Electric – Blackstart Restoration Study (earlier career) Tom conducted line and transformer energization studies for three restoration islands, in support of a readiness audit at NSTAR. Several mitigation options were developed for energizing a transformer-terminated line from a very weak source. He also supervised model development and simulation for station service motor starting dynamic simulations in the same study. An auditable final report for NERC was produced.

NSTAR– Electric Current Limiting Reactor TRV Study (earlier career) Tom analyzed the high-frequency TRV at eight 115-kV substations having current-limiting reactors (CLR) for shunt capacitor banks or underground cables. Capacitor bank or cable faults produce TRV in excess of the breaker rating, and these events have caused system disturbances due to backup clearing at other utilities. TRV mitigation for this issue was recommended at seven substations. During the study, concerns with outrush current limiting (from a dual bank) were identified at one substation, and bus-fault TRV concerns identified at two other substations. These extra study benefits resulted from the large system model developed for the study. In follow-on work, the CLR and TRV requirements for a new capacitor bank proposed for a ninth substation were studied efficiently, using the existing system model.

NSTAR Electric – SEMA Harmonic Study (earlier career) Tom performed harmonic simulations and power quality measurement analysis for the Cape Cod area, and reviewed bid specifications for dynamic reactive compensation in the area.

GE and Alliant Energy – Wind Plant Transient Studies (earlier career) Tom performed collector system transient model review and performed insulation coordination and transient recovery voltage studies for several proposed wind plants. These included Blue Sky, Goat Mountain, Flat Ridge, Fowler Ridge, and Locust Ridge.

Oak Creek Energy – Wind Plant TRV Study (earlier career) Tom performed a transient recovery voltage study for the Alta 4 wind plant near WindHub. It was necessary to model a significant portion of SCE's 500-kV system. TRV was relatively severe, and several mitigation options were developed. These included a different breaker location, external capacitance, and splitting a bus.

United Illuminating – Insulation Coordination Study (earlier career) Tom conducted a comprehensive review of surge arrester applications and insulation protective margins for all UI substations at 115-kV and above. This produced several recommendations for upgraded or additional surge arresters. A transient recovery voltage and insulation coordination study was also performed for the new 345-kV Singer gas-insulated substation (GIS). Because Singer is fed entirely by cable, new procedures were developed to define the appropriate incoming surge for GIS insulation coordination.

Hull Municipal Light, MA – Distributed Wind Interconnection Study (earlier career) Under contract to the University of Massachusetts, interconnection options and requirements were developed for a 12-MW near-offshore wind plant that has been proposed for Hull Municipal Light and Power. Although the project size is larger than the stated scope of IEEE Std. 1547, the study considered application of guidelines from IEEE Std. 1547. Voltage control, ampacity, reliability, islanding, flicker, harmonics, and overcurrent protection were all addressed in the study, with detailed feeder modelling and simulation.

Confidential Client – New Product Evaluation (earlier career) Tom led a team that assessed market acceptance and interconnection requirements for a new type of generation product. The final report clarified the requirements that would be applicable. This was of special concern to the client, since the rules vary by system operator and utility in North America, and the North American rules differ significantly from those in other parts of the world.

American Transmission Company – Hybrid Overhead-Underground Line Study (earlier career) Tom performed shunt compensation analysis, harmonic frequency scans, switching surge studies, and temporary overvoltage studies of a new 345-kV line proposed for the Madison, WI, area. Four route options were evaluated, each consisting of mixed overhead-underground line segments, in preparation for ATC's filing to the Public Service Commission of Wisconsin.

Telephone Interference Study – General Electric and KeySpan Energy (earlier career) Tom prepared a detailed coupling model for transmission line harmonics influence on local telephone circuits, along five transmission rights of way. Maps, tower drawings, and automated software tools were used to efficiently represent circuit segment lengths as short as 100 feet. This model was used to help evaluate harmonic filter designs and the need for mitigation.

TDE Alstom – Transient Recovery Voltage Studies (earlier career) Tom performed several TRV studies for Alstom switchgear customers, including failure investigations and generator breaker TRV.

SENELEC – DG Aggregation Feasibility Study (earlier career) Tom assisted with a feasibility study of DG aggregation for SENELEC, the state utility of Senegal, with USAID funding. The project included an on-site visit, economic evaluation, and conceptual design of the integration and control system. It was found that aggregation and dispatch of customer-owned backup generators could reduce the incidence of scheduled rolling blackouts in Senegal, which is caused by insufficient utility generating capacity.

John J. McMullen Associates – Shipboard Electrical System Analysis (earlier career) Using SPICE, Tom performed simulations and developed analysis tools for the all-electric destroyer project in the pre-bid

stage. This work was done for JJMA, a leading marine engineering firm (now part of Alion Science and Technology).

Southern Company Services – Harmonic Compliance Evaluation Tool (earlier career) Using Microsoft Excel and a commercial-grade harmonic simulation program, Tom developed an efficient and user-friendly tool for Southern Company to evaluate customer compliance with their new harmonics policy.

National Renewable Energy Laboratory – Ocean Current Energy System Evaluation (earlier career) Tom assisted with a feasibility study of the electrical collection system for proposed marine current turbines. An underwater cable expert was engaged to help evaluate the special cost and reliability concerns associated with this scheme.

Florida Power and Light – Safety Ground Study (earlier career) The utility wished to define safe grounding practices for live-line maintenance at 500 kV. Tom conducted a literature review, developed grounding analysis software, performed EMTP simulations of different grounding practices, and supervised construction of a physical model to demonstrate the recommendations to overhead line crews.

Various – Switching Surge Field Tests (earlier career) While at Westinghouse and Power Technologies, Tom led several switching surge and harmonics monitoring projects in the field. These included primarily electric arc furnace transformer commissioning tests and failure investigations in steel plants, but also included three switching surge tests in 500-kV substations. These 500-kV substations included Doubs (Allegheny Power System), Bath County pumped storage hydro/GIS (Virginia Power), and Conemaugh power plant (PEPCO). During this time, Tom contributed to an IEEE working group paper on performing switching surge tests in the field.

Various – EMTP and Transient Network Analyzer Studies (earlier career) While at Westinghouse, Tom performed many EMTP studies of series capacitor protection up to 500 kV, subsynchronous resonance, and static VAR generator applications on behalf of the Westinghouse apparatus divisions. Custom time-domain models and frequency-domain analysis techniques were developed to support some of these applications. He also performed EMTP and transient network analyzer (Anacom) studies of cable switching, overhead line switching, and shunt capacitor applications for several electric utility clients.

Various – Subsynchronous Resonance and Series Capacitor Studies (earlier career) Tom performed frequency scan evaluations for the MANDAN project and in support of several Westinghouse product bids. He also performed Dynamic Stabilizer studies in EMTP for the Tucson Electric Power installation, and for several Westinghouse bids. Tom also simulated series capacitor protection and control in EMTP, for several Westinghouse bids.

Industrial R&D Experience

Distributed Wind Impacts Project – Utility Wind Integration Group (UWIG). (2004-2013) This project involves development of a set of tools to aid utility distribution and planning engineers in analyzing wind generation at the distribution system level. The project began because other available tools do not address large sources on radial feeders, nor do they address variable power output. The web-based (www.variablegen.org/toolbox) software functions include:

- Flicker estimates, for both quick screening and more detailed evaluation
- Operational power flow and power factor analysis
- Fault analysis, with automated checking of overcurrent device coordination
- Grounding requirements and overvoltage protection
- Voltage control, including tap changers and capacitor switching
- Economic screening, with capacity factor estimates and financial sensitivity analysis
- Screening for jurisdictional fast-track project acceptance
- Automated generation of feeder electrical models
- Case studies, benchmarks, and on-line help

- Import of MultiSpeak files in batch mode

Work continued on flicker modeling of small wind turbines, and on expanding the library of machine models.

Distributed Solar Integration Methods – UWIG. (2010 – 2013) This project is cooperatively funded by National Renewable Energy Laboratory (NREL) and Canadian Electricity Association Technologies, Inc. (CEATI), and is expected to be a multi-year effort. It reflects UWIG's expansion from variable wind integration to include variable solar integration, and its pending name change to Utility Variable Generation Integration Group (UVIG). The project objective is to reduce barriers to the widespread adoption of photovoltaic (PV) generation on distribution feeders. The work currently underway or completed includes:

- Collection of PV data at 1-second time steps, and distribution feeder models, for testing.
- Implement the IEC flicker-meter algorithm in a feeder simulator, for assessment of voltage fluctuations during PV output variations.
- Identify a method of aggregating variable outputs from PV arrays in a small geographic area, for realistic assessments of the impact. Implement the chosen method, which is based on wavelets and a correlation scaling factor that depends on local conditions.
- Implement an automatic feeder model reduction and analysis procedure that will show variable PV impacts on capacitor banks, tap changers, reclosers, fuses, circuit breakers, and customer loads.
- Technical outreach to update IEEE Std. 1547 and present results to the "solar community".

Future tasks will focus on vendor-specific inverter modeling for interconnection studies, distributed storage, advanced feeder-level controls, and case studies.

A Heuristic Nonlinear Constructive Method for Electric Power Distribution System Reconfiguration (doctoral research, completed April 1998). Distribution feeders in North America usually operate in a radial configuration. A reconfiguration algorithm arranges tie switches to minimize losses (or some other objective), while meeting the radial condition and other constraints. This reconfiguration algorithm starts with all operable switches open, and at each step, closes the switch that results in the least increase in the objective function. The objective function is defined as incremental losses divided by incremental load served. A simplified loss formula is used to screen candidate switches, but a full load flow after each actual switch closing maintains accurate loss and constraint information. A backtracking option mitigates the algorithm's greedy search. This algorithm takes more computer time than other methods, but it models constraints and control action more accurately. A network load flow is used to provide a lower bound on the losses and a quality measure of the final solution. The algorithm was tested on several sample systems published by other authors and solved a problem with line voltage regulators that other published algorithms cannot handle. The algorithm was implemented in the Electric Power Research Institute (EPRI) DEWorkstation software product currently used by several utilities.

Feeder State Estimation with AMI and Advanced Sensors – California Institute for Energy and Environment (CIEE) (2009-2011). This project's objective was to develop and test state estimation algorithms with limited measurements at the substation, automated metering infrastructure (AMI) and low-cost wireless current sensors out on the feeder. It was possible to identify the distribution of loads among different circuit segments, and unbalanced phase currents and voltages. Interoperability and performance requirements were identified for the sensor manufacturer.

Power Factor Correction Capacitor Software Tool – Canadian Electricity Association Technologies, Inc. (CEATI) (2009-2011). This project was funded by the Power Quality Interest Group (PQIG) of CEATI. The software simulates customer facility performance over complicated load cycles, for accurate estimates of loss and energy bill reductions. Best practices for energy savings, voltage control, and harmonic performance were identified and presented as software tutorials. Utilities will use the tool to support their customers who are evaluating the purchase of power factor correction capacitors.

Distribution System Phasing Using AMI and DSCADA Information – CEATI (2009-2011). This project was funded by the Distribution Assets Life Cycle Management (DALCM) interest group of CEATI. The objective was to use AMI and Distribution System Supervisory Control and Data Acquisition (DSCADA) inputs to a state estimator to identify which meters are connected to the "wrong" phase. This information is valuable to the utility during outage restoration. Line post sensors were shown to provide cost-effective DSCADA inputs of current, voltage, real power, and reactive power. The project also helps utilities understand AMI hardware and system requirements for effective state estimation.

Distribution System State Estimation – U. S. Department of Energy (2006-2009). This project was funded by a Phase I small business and innovation research (SBIR) grant. Phase II funding was awarded through mid-2009. State estimation is a key enabler for any number of "smart grid" applications on the distribution system; these include reactive power management, outage management, loss reduction, demand response, adaptable over-current protection, condition-based maintenance, distributed generation dispatch, integration with transmission system operations, and more. Classical state estimation methods work poorly on distribution feeders for several reasons. In cooperation with NC State University, this project adapted an algorithm called Branch Current State Estimation (BCSE), which is more effective because it decouples the three phases of a distribution system and uses branch current instead of node voltage as a state variable. The project led to follow-up work on state estimation with CIEE and CEATI, as described above.

Standard Data Exchanges for Distribution System Management – U. S. Department of Energy (2006-2007). This project was funded by a Phase I SBIR grant. An open-source translator was developed between several software products, and a common format based on the National Rural Electric Cooperative Association (NRECA) MultiSpeak Initiative and the IEC standard Common Information Model with Distribution extensions (DCIM). Work in this area continued through participation in standards-making organizations, the IEC TC57 / WG14 and MultiSpeak.

Feeder Design for Distributed Generation – EPRI (2005-2006) – defined advanced feeder automation concepts that will enable distributed generation at high penetration levels. In 2005, several conceptual designs were prepared. The team also developed, for immediate usage, specific guidelines for utilities as they evolve toward advanced distribution systems. In 2006, the team prepared a design based on an IEEE test feeder, including the use of adaptive line regulator settings. Mappings from the DNP3 protocol to IEC 61850 were prepared for capacitor bank controllers and regulator tap changers, so that EPRI could continue with implementation work.

Power Quality Diagnostic System Lightning Surge Simulator – EPRI (1998) – simulates the low-side surge effects of lightning strokes to overhead primary feeders and secondary service drops. The software calculates peak voltages and metal-oxide varistor energy stress on the utility secondary and in customer facilities.

Power Quality Planning Software for Distribution Systems – EPRI (1997-1999) – calculates reliability indices and power quality indices for RMS voltage variations and sustained interruptions, based on statistical fault locations and types, with an event queue simulation of the overcurrent protection system. Aggregates the customer damage costs and utility costs over a planning horizon to compare power system designs. This resulted in the EPRI PQ Planner software.

Substation Design Workstation, Surge Analysis Module – EPRI (1997-1999) – contributed to initial specification of EPRI's SDWorkstation software, which is an aid for substation conceptual design, with detailed analysis of substation insulation coordination. Then implemented the surge analysis module; this uses a transient simulator and insulator volt-time model for insulation coordination analysis of lightning surges entering a substation. In version 2, contributed to other insulation coordination modules of SDWorkstation.

Lightning Protection Design Workstation – EPRI (1990-2000) – simulates the effect of direct and nearby lightning strokes on overhead and underground distribution lines. Tasks included the development of an efficient transient simulation engine, and a pole insulation design module. Uses ground flash density data

from the North American Lightning Detection Network. The software has been used by dozens of U. S. utilities for design studies. Capabilities include:

- Transient simulation of lightning strokes to overhead lines
- Line shielding design
- Grounding effects on lightning performance
- Insulation effects on lightning performance
- Surge arrester effects on lightning performance
- Extensive library of conductors, insulators, and surge arresters
- Scout, riser pole, and tap point arresters on distribution cable
- On-line reference and tutorial

Distribution Engineering Workstation Specification – EPRI (1989-1991) – surveyed electric utilities to determine their needs for integrated distribution system analysis and planning software. Developed detailed specifications that EPRI later used in adopting the Virginia Tech software that became the EPRI DEWorkstation. Later developed two applications to run in DEWorkstation. The first (see "doctoral research" above) uses a heuristic algorithm to reconfigure switches for loss minimization. The second accesses a power quality database to display state-estimated RMS variation indices on the circuit schematic.

Scoping Study for Enhancement of the Electromagnetic Transients Program – EPRI (1982-1986) – surveyed electric utilities to determine their needs for improving the Electromagnetic Transients Program (EMTP), wrote specifications that helped guide EPRI-funded activities to improve the EMTP. Produced the *EMTP Primer* and the *EMTP Application Guide* as the first in a series of new user documentation for the EMTP.

Software Development Experience

OpenDSS (2008-2023) – this is a time-stepping electric power system simulator, tailored for unbalanced systems, variable power and storage sources, and volt/var control studies, originally developed for consulting work at Electrotek and EPRI. Helped EPRI convert OpenDSS to an open-source release and upgraded the sparse matrix solver using the University of Florida's KLU library. Enhanced the OpenDSS simulation capabilities and automation interface for sample studies of switch reconfiguration for loss minimization, adaptive voltage regulation at a substation, and integrated volt/var control on a feeder. EPRI will use these capabilities to perform future advanced distribution automation and smart grid studies. Now developing re-factored 64-bit and Linux versions of OpenDSS, with Web service interfaces and user code model interfaces.

DG Evaluation Toolbox (2011-2014) – this is the results delivery system for an active research project with UVIG. It was originally implemented as a server-side Web application with Microsoft ASP.NET 2.x technology. A re-design and update is in progress using HTML5 technology to deliver a more interactive user interface with more complex feeder models, and to support Android / iPad tablets in addition to personal computers.

IEEE Flash (2010-2019) – leading the development of a modernized open-source program to support IEEE Standards 1243 and 1410, which cover lightning performance of electric power lines. The updates include line surge arresters, detailed models of poles and towers, and a spreadsheet user interface.

OpenEtran (2011) – converted the electromagnetic transient simulation engine from EPRI's LPDW research project, for release as an open-source program to support IEEE Flash. Replaced the "Numerical Recipes" routines with GNU Scientific Library in order to address open-source licensing concerns. Updated the user interface and manual. Prepared test cases and documentation for EPRI's Software Quality Assurance (SQA) procedure.

Ansoft's FEA Link (2002-2004) – lead developer for a time-domain co-simulation link between a finite element solver (Maxwell Transient) and a circuit simulation program (SIMPLORER). The solvers exchanged coupling matrix impedances and sources at each time step; they could run at different time steps and on different computers. Also re-implemented all of the SPICE-compatible models for SIMPLORER.

Electrotek Concepts - PQWeb v. 2.2 (1999-2000) – responsible for development of Web-based viewing software for power quality data. Wrote a component in C++ that queries a database, numerically processes data, outputs HTML tables, creates plots in Portable Network Graphics format, and writes compressed binary data files for download. The user interface was developed in Active Server Pages and HTML. Electric utilities use this product for Intranet and Internet applications. Electrotek also uses PQWeb to support a power quality monitoring service. See www.powermonitoring.com/pqwebdemo for a demonstration.

Electrotek Concepts - SuperHarm v. 4.2 (1999-2000) – responsible for development and maintenance of harmonic analysis software. SuperHarm performs harmonic power flow and frequency scan analysis of unbalanced three-phase power systems, and is used for IEEE Std. 519 compliance evaluations, harmonic filter design, and other power quality studies.

Electrotek Concepts - TOP 2000 (1999-2000) – responsible for development and maintenance of waveform plotting and post-processing software. The software plots data from a variety of instruments and simulation programs used in the electric power industry. As a means of enhancing company visibility, TOP is a free download from www.pqsoft.com/top. Over 700 copies were downloaded in that period.

Ansoft's Electromechanical System Simulator (1994-1997) – lead developer for product that uses finite element solutions to automatically generate equivalent circuit models for rotating machines, transformers, linear actuators, variable-reluctance sensors, rotating actuators, and other electromechanical devices. Implemented simulation models in a customized version of SPICE, and in Analogy's (now Synopsis's) Saber product. Implemented schematic capture and waveform calculator modules.

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76. T. E. McDermott, “Line Arrester Energy Discharge Duties”, 2006 IEEE/PES T&D Conference and Exposition Proceedings, 21-26 May 2006, Dallas, 5 pp.
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2. McDermott T.E., A. Bretas, K.I. Pitman, J.E. Dagle, R.F. Arritt, and T.J. Overbye. 2022. Industry Requirements for Geomagnetic Disturbance Models. PNNL-33200. Richland, WA: Pacific Northwest National Laboratory.
3. McDermott T.E., J. Xie, and M. Ramesh. 2022. Avista CEF2 Shared Energy Economy: Modeling and Simulation. PNNL-ACT-10127. Richland, WA: Pacific Northwest National Laboratory.
4. Anderson A.A., S.V. Vadari, J.L. Barr, S. Poudel, A. Dubey, T.E. McDermott, and R. Podmore. 2022. Introducing the 9500 Node Distribution Test System to Support Advanced Power Applications. PNNL-33471. Richland, WA: Pacific Northwest National Laboratory.
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7. McDermott T.E., N. Shepard, S. Meliopoulos, M. Ramesh, J. D. Doty, and J. T. Kolln. 2021. Protection of Distribution Circuits with High Penetration of Solar PV: Distance, Learning, and Estimation-Based Methods. PNNL-32230. Richland, WA: Pacific Northwest National Laboratory. doi: 10.2172/1834373.
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16. Tang Y., J.S. Homer, T.E. McDermott, M. Coddington, B. Sigrin, and B. Mather. 2017. *Summary of Electric Distribution System Analyses with a focus on DERs*. PNNL-26272. Richland, WA: Pacific Northwest National Laboratory. Summary of Electric Distribution System Analyses with a focus on DERs
17. Widergren S.E., D.J. Hammerstrom, Q. Huang, K. Kalsi, J. Lian, A. Makhmalbaf, and T.E. McDermott, et al. 2017. *Transactive Systems Simulation and Valuation Platform Trial Analysis*. PNNL-26409. Richland, WA: Pacific Northwest National Laboratory. Transactive Systems Simulation and Valuation Platform Trial Analysis

Non-Refereed Publications

1. McDermott, T.E., and S. Meliopoulos. 2021. "Protection of Distribution Circuits with High Penetration of Photovoltaics." Protection, Automation and Control World. PNNL-SA-159522. https://www.pacw.org/protection-of-distribution-circuits-with-high-penetration-of-photovoltaics
2. McDermott, T. E. 2019. "Commercial Buildings in Transactive System Simulations", IEEE TESC, Minneapolis, July 10, 2019.
3. McDermott, T. E. 2019. "Architectural Options for Transactive Software Agents in a Simulation with Communication Systems", IEEE TESC, Minneapolis, July 10, 2019.
4. McDermott T.E. 2017. "Did You Know - Transactive Energy Provides the Next Big Step in DER Integration." Connected - UVIG Newsletter. PNNL-SA-123492.
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7. R. C. Dugan, T. E. McDermott, "Distributed Generation", IEEE Industry Applications Magazine, vol. 8, no. 2, pp. 19-25, March/April 2002. (Prize Article for 2002).
8. R. C. Dugan, T. E. McDermott, G. J. Ball, "Planning for Distributed Generation", IEEE Industry Applications Magazine, vol. 7, no. 2, pp. 80-88, March/April 2001.
9. R. C. Dugan, T. E. McDermott, "Distributed Generation and Power Quality", PQA 2000 North America, May 15-18, 2000, Memphis, TN, 15 pp.
10. T. E. McDermott, R. C. Dugan, G. J. Ball, "A Methodology for Including Power Quality Concerns in Distribution Planning", 5th International Conference on Electrical Power Quality and Utilisation (EPQU 99), September 15-19, 1999, Cracow, Poland, 8 pp.
11. R. C. Dugan, T. E. McDermott, W. C. Roettger, "Distribution Planning with Distributed Generation", Latin America Power 99, June 29-July 1, 1999, Miami, FL.
12. S. Bhatt, T. E. McDermott, D. Brooks, R. C. Dugan, "Impact of Utility Lightning Protection Practices on Customer Facilities", PQA '99 North America, May 24-27, 1999, Charlotte, NC.
13. T. E. McDermott, R. C. Dugan, G. J. Ball, "Power Quality for Distribution Planning", PQA '98 North America, June 8-11, 1998, Phoenix, AZ.
14. T. McDermott, P. Zhou, J. Gilmore, Z. Cendes, "Simulation Models Magnets that Move," Machine Design, pp. 79-85, December 14, 1995.

University Teaching Activities

University of Pittsburgh (2012-2016) – as a full-time faculty member, taught several courses:

- ECE/CoE 0031 – Linear Circuits and Systems 1
- ECE/CoE 0041 – Linear Circuits and Systems 2
- ECE 1710 – Distribution and Smart Grid
- ECE 1771 – Electrical Machines (with lab). New lab and finite element modules. Flipped instruction delivery.
- ECE 2774 – Power System Analysis 2 (graduate)
- ECE 3778 – Power System Transients 2 (graduate). New course.
- ECE 2795 – Special Topics in Power: Sustainable Systems Modeling (graduate). New course.
- ECE 2795 – Special Topics in Power: Protective Relaying and Automation (graduate). New course.

Primary advisor for six graduate student dissertations:

- Matthieu Bertin, MS, "Counterpoise Model Implementation and New Graphical User Interface for Lightning Transient Analysis in OpenETran", September 2017.
- Andrew Reiman, Ph. D., "Model Segmentation and Simplification for Electric Power Distribution Systems", March 2017. (now at PNNL)
- Laura Wieserman, Ph. D., "Modeling Photovoltaic Inverter Transients using the Hammerstein-Wiener Method", November 2016. (now at University of Pittsburgh, Johnstown Regional Campus).
- Cedric Ofakem, MS, "Overvoltages Associated with Photovoltaic Inverter Transients", December 2015.
- Stephen Abate, MS, "Distribution System Modeling for Assessing Impact of Smart Inverter Capabilities", March 2015.
- Andrew Reiman, MS, "An Analysis of Distributed Photovoltaics on Single-Phase Laterals of Distribution Systems", March 2015.

Probability & Statistics Course (1985) – presented for the Westinghouse Advanced School in Power Systems Engineering. The course carried 3 credits by extension from the Penn State Greater Allegheny campus.

Industrial Teaching Experience

Distributed Wind Integration Seminar (2006-2014) – developed and presented two-day training seminars in distributed wind integration, for the Utility Wind Integration Group. The seminar was presented once each in Anchorage and once in Maui (one-day versions) and eight times in Golden, Colorado. Continuing Education Units are awarded.

Naval Surface Warfare Center (2009-2013) – developed and presented four customized shipboard electrical transient analysis and overcurrent protection workshops for the Naval Surface Warfare Center in Philadelphia. Also provided tutorial assistance on electric utility system power electronics applications and protective relaying.

Power Electronics with SPICE Tutorial (2000) – developed and presented this hands-on tutorial for the Pittsburgh Section IEEE. Thirty-five students attended and earned 1.0 Continuing Education Units from IEEE headquarters.

EPRI Lightning Protection Design Workstation Seminar (1992-2000) – this two-day hands-on seminar was presented five times at EPRI facilities and six times at client sites (Gulf States Utilities, Ameren UE, East Kentucky Power Cooperative, Southern Company Services, Duke Energy, and Entergy). Developed course materials and delivered lectures.

Electromagnetic Transients Program Training Seminar (1989-1990) – presented five-day hands-on training seminars at Con Edison and the Power Technologies home office in Schenectady, NY. Developed course materials and delivered lectures.