

EDWARD R. COLLINS, JR., Ph.D., P.E.

PROFESSIONAL EXPERIENCE

Western Carolina University

2022 – present, Dean, College of Engineering and Technology

2022 – present, Professor of Engineering

Clemson University

2022 – present, Professor of Electrical and Computer Engineering Emeritus

2021 – 2022, Academic and Technical Advisor, Dominion Energy Innovation
Center

2019 – 2021, Executive Director (interim), Dominion Energy Innovation Center

2016 – 2019, Associate Vice President (interim), Office of the Provost

2014 – 2022, Executive Director of Academic Initiatives, College of Engineering,
Computing, and Applied Sciences

2008 - 2014, Associate Dean, College of Engineering and Science

2008 - 2022, Professor of Electrical and Computer Engineering

1995 - 2008, Associate Professor of Electrical and Computer Engineering

1989 – 1995, Assistant Professor of Electrical and Computer Engineering

EDUCATION

Ph.D., Georgia Institute of Technology, 1989, Electrical Engineering

B.S., North Carolina State University, 1984, Electrical Engineering, *magna cum laude***LICENSES AND REGISTRATION**

Registered Professional Engineer (PE), South Carolina, (1993 -), No. 15234

FAA Pilot Certificates and Ratings

Airline Transport Pilot, Airplane Multi-Engine Land (1997 -)

Commercial Pilot, Airplane Single-Engine Land (1990 -) with Instrument Rating

Certified Flight Instructor (1991 -)

Airplane Single Engine

Airplane Multi-Engine

Instrument Airplane

Remote Pilot, small unmanned aircraft systems (UAS) (2021 -)

PROFESSIONAL DEVELOPMENT

“Higher Education Leadership Academy,” Clemson University (2006). I was selected by the Provost to participate in this monthly professional development training for aspiring campus leaders.

Harvard University, Graduate School of Education, Management Development Program (MDP), June 2010.

ACE Fellow, American Council on Education, 2012-2013. Host institution: Virginia Polytechnic Institute and State University (Virginia Tech), Office of the Senior Vice President and Provost, mentor: Dr. Mark McNamee.

Provost Fellow, Clemson University, 2013-2014. Coordinated online, off-campus, and summer sessions programs, and led initiatives on strategic planning, programming, financing, and tools; represented the Provost at various functions.

PROFESSIONAL MEMBERSHIPS

Member, Institute of Electrical and Electronics Engineers (IEEE), (1985 - present)
Senior Member (2007)

American Society for Engineering Education (ASEE), (2008 – present)
Co-Chair, Undergraduate Experience Committee (2015-2017)

OTHER LEADERSHIP

South Carolina Governor’s School for Science and Mathematics (GSSM)
Represented Clemson University on the Board of Trustees (for Provost Robert Jones) (2015-2020).

Global Engineering Education Exchange (Global E3)
Clemson University representative (2008 – 2022)
Executive Committee (elected by membership two consecutive terms) (2009 – 2022)
Chair, Executive Committee (elected by Executive Committee) (2018 – 2022)

National Council of Examiners for Engineering and Surveying (NCEES)
Principles and Practice Examination (PE) committee (1995 – 2002)
Fundamentals of Engineering (FE) committee (2002 – present)
Chair, Electrical Committee (2012-2014)
Vice Chair, FE Exam Full Committee (2014-2016)
Chair, FE Exam Full Committee (2016-2018)
Past Chair, FE Exam Full Committee (2018 – 2020)

HONORS AND AWARDS

Tau Beta Pi (1982)

Eta Kappa Nu (1982)

Graduate Teaching Assistant/Lecturer of the Year Award, Georgia Institute of Technology (1985 and 1987)

Whirlpool Fellowship, Georgia Tech (1986-1988)

NCR Outstanding Teaching Award, Clemson University (1991 and 1992)

NCR/AT&T Outstanding Teaching Award, Clemson University (1993)

AT&T Global Information Solutions Outstanding Teaching Award (1994)

Lewis T. Fitch Award for Excellence in Teaching, Clemson University ECE Dept. (1994)

Prize Paper Award for "Hypermedia-Based Courseware Development for Power Engineering Education," (with D. L. Lubkeman) from the IEEE Power Engineering Society -- Power Engineering Education Committee (1994)

J. W. Lathrop Outstanding Electrical Engineering Educator in South Carolina Award, South Carolina Council of the IEEE, Columbia, (1996)

Prize Paper Award for "Effects of Unsymmetrical Voltage Sags on Adjustable Speed Drives" (with A. Mansoor), Southern African Power Quality Conference, (1997).
Citation: "Most significant technical contribution to the conference."

Clemson University Board of Trustees "Award for Faculty Excellence," (1997)

Murray Stokely Award for Outstanding Teaching (the highest College of Engineering and Science Overall Teaching Award), Clemson University (2000)

Best Presentation Award, Electric Power Research Institute (EPRI) Power Quality PQA-North America 2002 Conference, Portland OR, for "Can a distributed generator make a voltage sag worse?" (2002)

Byars Prize for Outstanding Teaching (the highest College of Engineering and Science Teaching Award for Undergraduate Teaching), Clemson University (April 2000).

Provost's Higher Education Leadership Academy, Clemson University (April 2006 – November 2006).

Senior Member, Institute of Electrical and Electronics Engineers (IEEE) (January 2007).

Harris Outstanding Teaching Award, Dept. of ECE, Clemson University (Sept. 2007)

IEEE Power and Energy Society Prize Paper Award for Best Transactions Paper, July 2009, for “Voltage Sags and Distributed Synchronous Generator Control Response: A Case Study.”

Clemson University Board of Trustees “Award for Faculty Excellence,” (2010).

Fellow, American Council on Education (ACE), 2012.

Provost Fellow, Clemson University, 2013-2014.

Ralph Elliott Award for Leadership in Off-Campus, Distance, and Continuing Education, Clemson University, 2016.

Harris Outstanding Teaching Award, Dept. of ECE, Clemson University (2016, 2017, 2018, 2019)

Prize Paper Award for "Harmonic resonance repercussions of PV and associated distributed generators on distribution systems," 2017 IEEE North American Power Symposium (NAPS), Morgantown, WV, Sept. 2017. Authors: S. S. Rangarajan, E. R. Collins, J. C. Fox. This paper won the Student Award for Best Paper 2017 for the lead author Mr. Rangarajan was a PhD student under the supervision of Dr. Collins.

Elected to the Electrical and Computer Engineering Department “Hall of Fame”, North Carolina State University, 2017.

Distinguished Service Award, Institute for International Education (IIE), 2022

PUBLICATIONS

Standards

IEEE Standard 1159-2009, “Recommended Practice for Monitoring Electric Power Quality,” E. R. Collins, Jr., Chair of Working Group and Technical Editor, balloted and published in 2009. I led the committee that wrote and successfully balloted this national standard.

Refereed Journal Publications

D. L. Lubkeman and E. R. Collins, Jr., "Hypermedia-Based Courseware Development for Power Engineering Education," IEEE Transactions on Power Systems, 6 (3): 1259-1265 (August 1991).

E. R. Collins, Jr., "Torque and Slip Behavior of Single-Phase Induction Motors Driven from Variable Frequency Supplies," IEEE Transactions on Industry Applications, 28 (3): 710-715 (May/June 1992).

E. R. Collins, Jr. and Y. Huang, "A Programmable Dynamometer for Testing of Rotating Machinery," IEEE Transactions on Energy Conversion, 9 (3):521-527, (September 1994).

E. R. Collins, Jr. and R. L. Morgan, "A Three-Phase Sag Generator for Testing Industrial Equipment," IEEE Transactions on Power Delivery, 11 (1): 526-532 (January 1996).

S. W. Middlekauff and E. R. Collins, Jr, "System and Customer Impact: Considerations for Series Custom Power Devices," IEEE Transactions on Power Delivery, 13(1): 278 – 283 (January 1998).

E. R. Collins, Jr. and S. G. Whisenant, "Evaluating the Tradeoffs Between Regenerative Inverters and Dynamic Braking," Energy Engineering, a Journal of the Association of Energy Engineers, vol. 104, no. 5, pp. 60 – 80 (August-September 2007).

E. R. Collins, Jr. and J. Jiang, "Voltage Sags and Distributed Synchronous Generator Control Response: A Case Study," IEEE Transactions on Power Delivery, vol. 23, no. 1, January 2008, pp. 442 – 448. *This paper received the IEEE Power Engineering Society Prize Paper Award, presented at the IEEE PES Annual Meeting Awards Ceremony in Calgary, Alberta in July 2009.*

E. R. Collins, Jr., "An Energy Conversion Laboratory Using Industrial-Grade Equipment," IEEE Transactions on Power Systems, vol. 24, no. 1, pp. 3 – 11, February 2009.

E. R. Collins, Jr. and J. Jiang, "Analysis of Elevated Neutral-to-Earth Voltage in Distribution Systems with Harmonic Distortion," IEEE Transactions on Power Delivery, vol. 24, no.3, pp. 1696-1702, July 2009.

J. Shirley, J. Wagner, R. Collins, A. Gramopadhye, T. Schweisinger, and M. Hanna, "A Mechatronics and Material Handling Systems Laboratory - Experiments and Case Studies," International Journal of Electrical Engineering Education, vol. 48, no. 1, January 2011, pp. 92-103.

R. Patil, J. Wagner, T Schweisinger, E. R. Collins, A. Gramopadhye, and M. Hanna, "A Multi-Disciplinary Mechatronics Course with Assessment – Integrating Theory and Application through Laboratory Activities," International Journal of Engineering Education, vol. 28, no. 5, pp. 1141-1149, 2012.

M. McKinney, J. C. Fox, E.R. Collins, and K. Bulgakov, "Design, Development, and Commissioning of a Multi-Megawatt Test Facility for Renewable Energy Research," IEEE Transactions on Industry Applications, vol. 52, no. 1, Jan/Feb 2016, pp. 11-17.

S. S. Rangarajan, E. R. Collins, J. C. Fox, and D.P. Kothari, "Consolidated compendium of PV interconnection standards across the globe in a smart grid environment," Journal of Energy Technology Research, vol 2, no. 1, May 2018, pp 1-29.

S. S. Rangarajan, E. R. Collins, J. C. Fox, "Smart PV and SmartPark Inverters as suppressors of Temporary Over-Voltage (TOV) phenomenon in distribution systems", IET Generation, Transmission and Distribution Journal, Volume 12, Issue 22, December 2018, p. 5909 – 5917.

S. S. Rangarajan, E. R. Collins, and J. C. Fox, "Efficacy of a Smart Photovoltaic Inverter as a Virtual Detuner for Mitigating Network Harmonic Resonance in Distribution Systems," Electric Power Systems Research, February 2019, 171 (2019), pp. 75-184.

F. Tooryan, H. HassanzadehFard, E.R. Collins, S. Jin, B. Ramezani, "Optimization and Energy Management of Distributed Energy Resources Investments for a Hybrid Residential Microgrid," Journal of Energy Storage, vol. 30, August 2020.

F. Tooryan, H. HassanzadehFard, E.R. Collins, S. Jin, "Smart Integration of Renewable Energy Resource, Electrical and Thermal Energy Storage in Microgrid Applications," Journal of Energy, Elsevier, vol. 212(C), 2020.

F. Tooryan, H. HassanzadehFard, E.R. Collins, S. Jin, B. Ramezani, "Design and Optimum Energy Management of a Hybrid Renewable Energy System Based on Efficient Various Hydrogen Production," International Journal of Hydrogen Energy, Elsevier, Vol. 45, Issue 55, 6 November 2020, Pages 30113-30128.

M. M. Irfan, S. S. Rangarajan, E. R. Collins, and T. Senjyu, "Enhancing the Power Quality of the Grid Interactive Solar Photovoltaic-Electric Vehicle System," World Electric Vehicle Journal, 2021, vol. 12, no. 3, article 98, 2021, <https://doi.org/10.3390/wevj12030098>

A. Nakadomari, R. Miyara, T. Alharbi, N. Prabakaran, S. S. Rangarajan, E. R. Collins, T. Senjyu, "Dynamic Voltage Stability Assessment in Remote Island Power System with Renewable Energy Resources and Virtual Synchronous Generator," Energies, 2021; vol. 14, no. 18, article 5851. <https://doi.org/10.3390/en14185851>

S. P. Sunddararaj, S. S. Rangarajan, S. Nallusamy, T. Senjyu, and E. R. Collins, "A Survey on Important Interconnection standards for Photovoltaic Systems and Electric Vehicles," World Electric Vehicle Journal, 2021, vol 12, no. 3, article 117. <https://doi.org/10.3390/wevj12030117>

V. Basetti, S. S. Rangarajan, C. K. Shiva, H. Pulluri, R. Kumar, E. R. Collins, T. Senjyu, "Economic Emission Load Dispatch Problem with Valve-Point Loading Using a Novel Quasi-Optimizational Based Political Optimizer," Electronics, 2021, 10(21), 2596, <https://doi.org/10.3390/electronics10212596>, October 2021.

- A. Ahmadi, M. Smith, E. R. Collins, Jr., V. Dargahi, and S. Jin, "Fast Newton-Raphson Power Flow Analysis Based on Sparse Techniques and Parallel Processing," IEEE Transactions on Power Systems, 10.1109/TPWRS.2021.3116182, Sept. 2021.

S. R. Pendem, S. Mikkili, S. S. Rangarajan, AVV Sudhakar, E. R. Collins, T. Senjyu, "Optimal Hybrid PV Array Topologies to Maximize Power Output by Reducing the Effect of Non-Uniform Operating Conditions," Electronics, 2021, 10, 3014, <https://doi.org/10.3390/electronics10233014>, December 2021.

R. R. Singh, M. Baranidharan, U. Subramaniam, S. S. Rangarajan, E. R. Collins, T. Senjyu, H. Ahmed, "An Energy-Efficient Start-up Strategy for Large Variable Speed Hydro Pump Turbine Equipped with Doubly Fed Asynchronous Machine," Energies, 15(9): 3138, April 2022.

S. Sunddararaj, S. S. Rangarajan, S. Nallusamy, U. Subramaniam, E. R. Collins, and T. Senjyu, "Design of Novel HG-SIQBC-Fed Multilevel Inverter for Standalone Microgrid Applications," Appl. Sci., 2022, 12, 9347, Sept 2022.

S. S. Rangarajan, S. Sunddararaj, A. Sudhakar, C Shiva, U. Subramaniam, E. R. Collins, and T. Senjyu, "Lithium-Ion Batteries – The Crux of Electric Vehicles with Opportunities and Challenges," Clean Technol. 2022, 4, 908-930, Sept. 2022.

R. Durgam, R. Karampuri, S. S. Rangarajan, E. R. Collins, T. Senjyu, "Investigations on the Modulation Strategies for Performance Improvement of a Controlled Wind Energy System," Electronics, 2022, 11, 3931. <https://doi.org/10.3390/electronics11233931>, Nov 2022.

Conference Proceedings (Full Paper Reviewed)

E. R. Collins, Jr., H. B. Puttgen, and W. E. Sayle, II, "Single-Phase Induction Motor Adjustable Speed Drive: Direct Phase Angle Control of the Auxiliary Winding Supply," 1988 IEEE Industry Applications Society Meeting Record, Pittsburgh, PA, October 1988. pp. 246 – 252.

E. R. Collins, Jr., "Torque and Slip Behavior of Single-Phase Induction Motors Driven from Variable Frequency Supplies," 1990 IEEE Industry Applications Society Annual Meeting Record, Seattle WA, October 1990, pp. 61 –66.

E. R. Collins, Jr. and R. E. Ashley, "Operating Characteristics of Single-Phase Capacitor Motors Driven from Variable Frequency Supplies," 1991 IEEE Industry Applications Society Annual Meeting Record, Dearborn, MI, September 1991, pp. 52 – 57.

E. R. Collins, Jr. and P. B. Boyd, "Improved Methods for Determining the Equivalent Circuit Parameters for Single-Phase Induction Motors Models," IEEE Industry Applications Society Annual Meeting, Toronto, October 1993, pp. 390 – 397.

J. J. Carroll, E. R. Collins, Jr., and D. A. Dawson, "A Nonlinear Control Technique for the Development of a Computer Controlled Dynamometer," ASME Dynamic Systems and Control Conference, November 1993, pp. 31 –36.

D. L. Lubkeman and E. R. Collins, Jr., "Hypermedia-Based Courseware Development

for Power Engineering Education," 1991 IEEE Power Engineering Society Winter Meeting, paper number 91 WM 080-2 PWRs, Columbus OH, January 1991.

E. R. Collins, Jr. and Y. Huang, "A Programmable Dynamometer for Testing of Rotating Machinery," 1994 IEEE Power Engineering Society Winter Meeting, paper number 94 WM 116-4 EC, New York, January 1994.

E. R. Collins, Jr. and R. L. Morgan, "A Three-Phase Sag Generator for Testing Industrial Equipment," 1995 IEEE Power Engineering Society Summer Meeting, paper number 95 SM 393-9 PWRD, Portland, Oregon, June 1995.

E. R. Collins, Jr., M. Sahpolat, E. Zapardiel, and R. L. Morgan, "Generating Unbalanced Voltage Sags with Synchronous Machines," Proceedings of the 1996 7th International Conference on Harmonics and Quality of Power (ICHQP), Las Vegas NV, October 1996, pp. 265 – 269.

A. Mansoor, E. R. Collins, Jr., and R. L. Morgan, "Effects of Unsymmetrical Voltage Sags on Adjustable Speed Drives," Proceedings of the 1996 7th International Conference on Harmonics and Quality of Power (ICHQP), Las Vegas NV, October 1996, 467 – 472.

A. E. Turner and E. R. Collins, Jr., "The Performance of AC Contactors During Voltage Sags," Proceedings of the 1996 International Conference on Harmonics and Quality of Power (ICHQP), Las Vegas NV, October 1996, pp. 589 – 593.

N. S. Tunaboylu and E. R. Collins, Jr., "The Wavelet Transform Approach to Detect and Quantify Voltage Sags," Proceedings of the 1996 International Conference on Harmonics and Quality of Power (ICHQP), Las Vegas NV, October 1996, pp. 619 – 624.

E. R. Collins, Jr., and M. A. Bridgwood, "The Impact of Power System Disturbances on AC-Coil Contactors," Proceedings of the 1997 IEEE Textile, Film, and Fiber Industry Conference, Greenville SC, May 1997, pp. 2 – 8.

E. R. Collins, Jr. and A. Mansoor, "Effects of Voltage Sags on AC Motor Drives," Proceedings of the 1997 IEEE Textile, Film, and Fiber Industry Conference, Greenville SC, May 1997, pp. 9 – 16.

A. Mansoor and E. R. Collins, Jr., "Effects of Unsymmetrical Voltage Sags on Adjustable Speed Drives," Proceedings of the Southern African Power Quality Conference, May 12 - 14, 1997. *This paper received the prize paper award. Citation: "Most significant technical contribution to the conference."*

M. H. J. Bollen, A. Mansoor, and E.R. Collins, Jr., "Characteristics of Voltage Sags Experienced by Single-Phase and Three-Phase Equipment," Proceedings of PQA '97 - Europe (Power Quality Applications Conference), Stockholm, Sweden, June 16 - 18, 1997.

A. Mansoor, E. R. Collins, Jr., M.H.J. Bollen, S. Lahaie, "Behaviour of Adjustable Speed Drives During Phase Angle Jump and Unbalanced Sags," Proceedings of PQA '97 - Europe (Power Quality Applications Conference), Stockholm, Sweden, June 16 - 18, 1997.

S. W. Middlekauff, E. R. Collins, Jr, "System and Customer Impact: Considerations for Series Custom Power Devices," 1997 IEEE Power Engineering Society Summer Meeting, Paper number 97 SM 987-0-04 PWRD, Berlin, Germany, July 1997.

E. R. Collins, M. J. H. Bollen, and A. Mansoor, "Voltage Sags Experienced by Single-Phase and Three-Phase Equipment Recommendations for Immunity Tests," 32nd Universities Power Engineering Conference (UPEC '97), University of Manchester, September 10-12, 1997, pp. 238 – 241.

E. R. Collins, Jr. and F. Zapardiel, "An Experimental Assessment of AC Contactor Behavior During Voltage Sags," Proceedings of the 1997 IEEE International Symposium on Industrial Electronics (ISIE '97), Guimaraes, Portugal, July 7- 11, 1997, pp. 439 – 444.

R. L. Langley, A. Mansoor, E. R. Collins, and R. L. Morgan, "Voltage Sag Ride-thru Testing of Adjustable Speed Drives Using a Programmable Dynamic Dynamometer" Proceedings of the 1998 EPRI Power Quality Assurance (PQA) Conference, Phoenix AZ, June 1998.

R. L. Langley, A. Mansoor, E. R. Collins, and R. L. Morgan, "Voltage Sag Ride-thru Testing of Adjustable Speed Drives Using a Programmable Dynamic Dynamometer" Proceedings of the 1998 International Conference on Harmonics and Quality of Power (ICHQP), Athens Greece, October 1998, pp. 566 – 571.

N. S. Tunaboylu, E. R. Collins, and P. R. Chaney, "Voltage Disturbance Evaluation Using the Missing Voltage Technique," Proceedings of the 1998 International Conference on Harmonics and Quality of Power (ICHQP), Athens Greece, October 1998, pp. 577 – 582.

E. R. Collins, J. Jiang, R. Barnett, R. L. Morgan, and J. Hinson, "Could a Distributed Generator Make a Voltage Sag Worse?," Proceedings of the 2002 EPRI PQA North America Conference, Portland OR, June 2002.

E. R. Collins, Jr. and Ran Cao, "A Matlab-Based Simulation Tool for Predicting the Behavior of Electric Motors and Drives during Voltage Disturbances," Proceedings of the 2002 IEEE International Conference on Harmonics and Quality of Power, Rio de Janeiro Brazil, pp. 353 – 358, October 2002.

E. R. Collins, Jr and N. S. Tunaboylu, "Ride-through compensation of an industrial mixer drive subjected to voltage sags," Proceedings of the 2002 IEEE International Conference on Harmonics and Quality of Power, Rio de Janeiro Brazil, pp. 553 – 558, October 2002.

S. W. Middlekauff, A. Mansoor, and E. R. Collins, Jr., "Case Study: Undervoltage from Single-Phasing of Ungrounded Wye-Delta Transformer Bank," Proceedings of the 2003 EPRI Power Quality PQA Conference, Monterrey CA, June 2003.

E. R. Collins and J. Jiang, "The Role of a Distributed Synchronous Generator on Voltage Sags," Proceedings of the 2004 IEEE International Conference on Harmonics and Quality of Power, Lake Placid NY, pp. 637 – 641, September 2004.

S. J. Hubbard and E. R. Collins, "Uses of Signal Derivatives in Analysis of Voltage Sags," Proceedings of the 2004 IEEE International Conference on Harmonics and Quality of Power, Lake Placid NY, pp. 531 – 536, September 2004.

E. R. Collins, G. Stout, S. G. Whisenant, "A Distribution Network Analyzer for Power Quality Studies," Proceedings of the 2004 IEEE International Conference on Harmonics and Quality of Power, Lake Placid NY, pp. 642 – 646, September 2004.

N. S. Tunaboylu and E. R. Collins, "Response Analysis of An Industrial Mixer Drive Subjected to Voltage Sags *Part I: Modeling and Simulation Results*," Proceedings of the 2004 IEEE International Conference on Harmonics and Quality of Power, Lake Placid NY, pp. 312 – 317, September 2004.

N. S. Tunaboylu and E. R. Collins, "Response Analysis of An Industrial Mixer Drive Subjected to Voltage Sags *Part II: Experimental Design and Results*," Proceedings of the 2004 IEEE International Conference on Harmonics and Quality of Power, Lake Placid NY, pp. 318 – 323, September 2004.

O. C. Parks, M. A. Bridgwood, and E. R. Collins, "Using Macromodels to Evaluate a Process Control System's Response to Voltage Sags," Proceedings of the 2004 IEEE International Conference on Harmonics and Quality of Power, Lake Placid NY, pp. 717 – 720, September 2004.

E. R. Collins and J. Jiang, "The Effect of Harmonic Loads on Elevated Neutral-to-Earth Voltage," Proceedings of the 2006 IEEE International Conference on Harmonics and Quality of Power, Cascais (Lisbon), Portugal, October 2006.

E. R. Collins, H.-J. Kim, and T. Smith, "Voltage Sag Compensation using a Six-Pulse Inverter and Split-Wye Transformer," Proceedings of the 2006 IEEE International Conference on Harmonics and Quality of Power, Cascais (Lisbon), Portugal, October 2006.

E. R. Collins, J. R. Shirley, J. C. Fox, "An Experimental Investigation of Third Harmonic Current Distortion in Single-Phase Induction Motors," Proceedings of the 2008 IEEE International Conference on Harmonics and Quality of Power, Wollongong, Australia, October 2008.

E. R. Collins and J. C. Fox, "Commutation Failure of DC Motor Drives from Voltage Sags During Regeneration," Proceedings of the 2008 IEEE International Conference on Harmonics and Quality of Power, Wollongong, Australia, October 2008.

J.C. Fox and E.R. Collins, "A Voltage Flicker Suppression Device for Residential Air Conditioners and Heat Pumps," 2010 IEEE International Conference on Harmonics and Quality of Power, Bergamo, Italy, September 2010.

C. May and E. R. Collins, "An Investigation of the Response of Incandescent Lamps and Compact Fluorescent Lamps to Voltage Fluctuations," 2010 IEEE International Conference on Harmonics and Quality of Power, Bergamo, Italy, September 2010.

S. Altaf, L. Shuman, E. R. Collins, and E. Doerry, "Joining Hands: Using Consortia to Efficiently Create Easily Accessible International Experiences for Engineering Students," Proceedings of ASEE Annual Meeting and Exposition, Indianapolis IN, June 2014.

G. Singh and E. R. Collins, "Influence of Auxiliary Winding Resonance on the Harmonic Behavior of Single-Phase Capacitor Motors," 2014 IEEE Power and Energy Society Annual Meeting, Washington DC, July 2014.

J. C. Fox, E. R. Collins, M. McKinney, K. Bulgakov, and T. Salem, "A Multi-Megawatt Test Facility for Renewable Energy Research", 2014 Industry Applications Society Annual Meeting, Paper 2014-PSEC-0282, Vancouver BC, Canada, October 2014.

F. Tooryan, E. R. Collins, A. Ahmadi and S. S. Rangarajan, "Distributed Generators Optimal Sizing and Placement in a Microgrid using PSO", IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA), San Diego, Nov. 2017, pp. 614-619.

S. S. Rangarajan, E. R. Collins, J. C. Fox, "Harmonic resonance repercussions of PV and associated distributed generators on distribution systems," 2017 IEEE North American Power Symposium (NAPS), Morgantown, WV, Sept. 2017. (This paper won the Student Award for Best Paper 2017.)

S. S. Rangarajan, E. R. Collins, J. C. Fox, and D. P. Kothari, "A Survey on Global PV Interconnection Standards", IEEE Power and Energy Conference at Illinois (PECI), Feb. 2017.

S. S. Rangarajan, E. R. Collins, J. C. Fox, "Interactive impacts of elements of distribution systems on network harmonic resonances," 6th IEEE International Conference on Renewable Energy Research and Applications, San Diego CA, 2017.

S. S. Rangarajan, E. R. Collins, J. C. Fox, "Detuning of Harmonic Resonant Modes in Accordance with IEEE 519 Standard in an Exemplary North American Distribution System with PV and Wind," 6th IEEE International Conference on Renewable Energy Research and Applications, San Diego CA, 2017.

S. S. Rangarajan, E. R. Collins, J. C. Fox, "Comparative Impact Assessment of filter elements associated with PWM and Hysteresis controlled PV on network harmonic resonance in distribution systems," 6th IEEE International Conference on Renewable Energy Research and Applications, San Diego CA, 2017.

F. Tooryan and E. R. Collins, "Optimum Size and Placement of Distributed Generators in Microgrid Based on Reliability Concept", IEEE Power and Energy Conference at Illinois (PECI), Champaign IL, Feb. 2018, pp. 1-6.

A. Ahmadi, S. Jin, M. C. Smith, E. R. Collins, and A. Goudarzi, "Parallel Power Flow based on OpenMP," 2018 North American Power Symposium (NAPS), IEEE, Sept. 2018. pp. 1-6.

F. Tooryan and E. R. Collins, "The Assessment of Rooftop PVs' Smart Inverter Functions on System Voltage and Power Loss", 2018 IEEE International Conference on New Trends in Engineering & Technology (ICNTET), Chennai, India, 2018.

A. Shadman, F. Tooryan, M. Tasdighi, Y. Kenarangui, S. Kamalinia, and E. R. Collins, "Microgrids: A Solution Towards Implementing Demand Response Programs", IEEE Texas Power and Energy Conference (TPEC), College Station, TX, Feb. 2020.

F. Tooryan, E.R. Collins, and A. Shadman, "Assessing the Impact of Smart Inverter's Functions on Power Quality in Rooftop PV Applications", IEEE Power System Conference (PSC), Clemson, SC, March 2020.

F. Tooryan, A. Shadman, S.Kamalinia, and E. R. Collins, "Application of a Remote Area Microgrid for Improving Reliability and Resiliency", IEEE Power System Conference (PSC), Clemson, SC, March 2020.

S. P. Sunddararaj, S. S. Rangarajan, N. Subashini, U. Subramaniam, E. R. Collins, Jr., T. Senjyu, "A novel T-Type Multilevel Inverter for Electric Vehicle and Grid-Connected Applications," 2021 7th International Conference on Electrical Energy Systems (ICEES), Feb. 2021.

S. P. Sunddararaj, S. S. Rangarajan, U. Subramaniam, E. R. Collins, Jr., T. Senjyu, "Performance of P/PI/PID Based controller in DC-DC Converter for PV applications and Smart Grid Technology," 2021 7th International Conference on Electrical Energy Systems (ICEES), Feb. 2021.

S. P. Sunddararaj, S. S. Rangarajan, U. Subramaniam, E. R. Collins, Jr., T. Senjyu, "A new topology of DC-DC Converter with Bidirectional Power Flow Capability Coupled with a Nine Multilevel Inverter for EV Applications," 2021 7th International Conference on Electrical Energy Systems (ICEES), Feb. 2021.

S. Jons and E. R. Collins, "Global STEM Partnerships via Consortium Models for Resilience During a Pandemic," proceedings of the American Society for Engineering Education (ASEE) Annual Meeting, (presented in the International Division), July 2021.

P. Neo, E. R. Collins, N. Downing, D. Fabregue, "Facilitation of a Global Engineering Education Experience through Consortium Membership," in preparation for American

Society for Engineering Education (ASEE) Annual Meeting (International Division), June 2022.

Conference Proceedings (Abstract or Digest Reviewed)

H. B. Puttgen, E. R. Collins, Jr., D. G. Rouaud, and R. P. Webb, "Mathematical Models for Variable Speed AC Motors," NAS-ASUSSR Energy Conservation R&D Symposium, USSR, October 1988.

S. M. Camacho and E. R. Collins, Jr., "A Harmonic Model of a 2-Pulse DC Motor Drive Operating in the Continuous Current Mode," 1994 Proceedings of IEEE Southeastcon, Miami, FL, April 1994, pp. 40 – 44.

N. S. Tunaboylu, E. R. Collins, Jr., S. W. Middlekauff, and R. L. Morgan, "Ride-Through Issues for DC Motor Drives During Voltage Sags," 1995 Proceedings of IEEE Southeastcon, Raleigh NC, March 1995, pp. 52 – 58.

M. A. Bridgwood, J. Spangler, P. Miroftsalis, E. R. Collins, Jr., "Characterizing the Behavior of a Multi-Loop Model Industrial Process Subjected to Complex Power Supply Voltage Sags," Proceedings of the Eleventh International Power Quality '98 Symposium, Santa Clara, CA, pp. 414 – 425, Nov. 1998.

M. A. Bridgwood, P. Miroftsalis, E. R. Collins, Jr., and J. Spangler, "Sag Injection/Detection Systems for PLC-Based Industrial Process Control Applications," Proceedings of the Eleventh International Power Quality '98 Symposium, Santa Clara, CA, pp. 511 – 519, Nov. 1998.

E. R. Collins, R. L. Morgan, and J. Hinson, "Interfacing Standby Generation with the Utility Grid using Standard Regenerative AC Adjustable Speed Motor Drives," invited panel discussion paper, EPRI PQA North America Conference, Pittsburgh PA, June 2001.

J. Jiang and E. R. Collins, Jr., "Modeling the Behavior of a Synchronous Distributed Generator During Fault Conditions," Power Systems Conference 2003: Distributed Generation and Advanced Metering, Clemson SC, March 2003.

N. S. Tunaboylu and E. R. Collins, Jr., "Ride-Through Compensation of An Industrial Mixer Drive Subjected to Voltage Sags," Proceedings of the International Conference on Electrical and Electronics Engineering (ELECO 2003), Bursa, Turkey, December 2003.

E. R. Collins, "The Rockwell Motors and Drives Laboratory at Clemson University," National Science Foundation Workshop on Teaching of Drives and Power Electronics and Their Application in Power Systems, Las Vegas NV, February 2004.

E. R. Collins and J. Jiang, "Power Quality Impact of a Synchronous DG on a Distribution System," Panel Session paper, Power Systems Conference 2004: Distributed Generation and Advanced Metering, Clemson SC, March 2004.

Y-J Shin, R. Dougal, J. B. Park, E. Powers, and E. R. Collins, "Joint Time-Frequency Domain Reflectometry for Diagnostics of Coaxial Cables," 6th Joint NASA/DOD/FAA Conference on Aging Aircraft, Palm Springs CA, January 2005.

M. Bridgwood, E. R. Collins, and Y-J Shin, "Using an Electrical Attribute Database as a Maintenance Tool for Small General Aviation Aircraft," 7th Joint NASA/DOD/FAA Conference on Aging Aircraft, Atlanta GA, March 2006.

E. R. Collins, "Standardizing Power Quality Monitoring and Measurement Methods," Invited paper at the "PQ Standards Roadmap with IEEE/IEC Coordination" panel session, IEEE PES Transmission and Distribution Conference and Exposition, Dallas TX, May 2006.

E. R. Collins and J. Jiang, "Elevated NEV due to Triplen Harmonics: Modeling and Results." Invited paper at the Stray Voltage Panel Session, IEEE PES Transmission and Distribution Conference and Exposition, Dallas TX, May 2006.

E. R. Collins, "Elevated Neutral to Earth Voltages Due to Harmonics – A T&D Update," Invited paper, Stray Voltage Panel Session, IEEE PES Transmission and Distribution Conference and Exposition, Chicago IL, April 2008.

J. Shirley, J. Wagner, E. R. Collins, A. Gramopadhye, "A Mechatronics and Material Handling Systems Course – Classroom Topics, Laboratory Experiments, and a Design Project," paper number AC 2009-809, session 1676, Proceedings of the 2009 ASEE Annual Meeting, Austin TX, June 2009.

E. Stephan, E. R. Collins, and C. Porter, "Integrating Recruiting into the First Year Experience: An Opportunity to Boost Enrollment and Retention," Proceedings of the 2013 ASEE Annual Meeting, Atlanta GA, June 2012.

G. Singh and E. R. Collins, "Harmonic Filtering Phenomenon in Single-Phase Induction Motors," a poster paper accepted for the IEEE T&D Conference and Exposition, April 2014.

F. Tooryan and E.R. Collins, "Optimal Design and Operation Cost of Distributed Energy Resources in An Isolated Microgrid", 2019 IEEE PES General Meeting, Atlanta, GA (poster).

A. Ahmadi, M. C. Smith, E. R. Collins, and A. Goudarzi, "A Performance Comparison of Parallel Power Load Flow Implementations: 2019 IEEE PES General Meeting, Atlanta, GA (poster).

E. R. Collins, S. Jons, and V. Misquita, "Consortium-based Model to Foster Resilience," to appear at the 24th Annual Colloquium on International Engineering Education (ACIEE 2021), Purdue University, November 2021.

Major Research Reports

"Multi-Institutional Mechatronics and Material Handling Educational Laboratories – course Development and Student Collaboration," NFS Final Project Report for Award #0632800 (August 2011), Co-PI with PI John Wagner.

"Waveform Characteristics of Voltage Sags: Definition and Algorithm Development," Report TR-113044, Electric Power Research Institute (EPRI), Palo Alto CA, (April 1998).

"PCS-Microcell Power by Light," BellSouth Telecommunications, Atlanta GA, (November, 1994).

"Power by light: The State of the Art for Technology", BellSouth Telecommunications, Atlanta, GA, (December, 1992).

Other Publications

J. C. Fox, E. R. Collins, Jr., N. Rigas, "The Clemson University 15 MW Hardware-In-the-Loop (HIL) Grid Simulator," AWEA Windpower Conference 2012, Atlanta GA (June 2012).

IEEE Recommended Practice for Monitoring Electric Power Quality, IEEE Std 1159-1992 (R2001), chair of committee, reaffirmed by ballot (2001)

E. R. Collins, Jr., "Laser Bandwidth Studies on Cabled 62.5/125 μ m Spectran Multimode Fiber," Internal Memorandum, AT&T/Bell Laboratories, 54543-850830-01IM, File Case 40461-020, (August 1985).

E. R. Collins, Jr., "Frequency Domain Laser Bandwidth Measurement Techniques on Multimode Fibers, Internal Memorandum, AT&T/Bell Laboratories, 54543-850925-01-IM, File Case 40461-020, (September 1985).

E. B. Makram and E. R. Collins, Jr., "ECE 412 Notes: Electric Power System Laboratory," Dept. of Electrical and Computer Engineering, Clemson University Campus Publishing, Fall 1990.

E. R. Collins, Jr., "P.E. Review Notes #21: Practice-Oriented Electric Circuit Analysis," Continuing Engineering Education, Clemson University, first edition June 1992, revised through 2012.

E. R. Collins, Jr., "P.E. Review Notes #23: Power System Analysis I," Continuing Engineering Education, Clemson University, based on originals from D. L. Lubkeman, 2nd revision 2003, revised through 2012..

E. R. Collins, Jr., "P.E. Review Notes #24: Power System Analysis II," Continuing Engineering Education, Clemson University, based on originals from D. L. Lubkeman, 2nd revision 2003, revised through 2012..

E. R. Collins, Jr., "P.E. Review Notes #25: Electric Machinery," Continuing Engineering Education, Clemson University, first edition April 1992, revised through 2012.

Educational Materials

"PE Review: Transmission and Distribution," a three-hour video and accompanying workbook, published by IEEE Educational Activities Board, Order No. HV7026/HV7032, (October 1998, 1999).

"PE Review: Machinery and Applications," a three-hour video and accompanying workbook, published by IEEE Educational Activities Board, Order No. HV7028/HV7033, (October 1998, 1999).

SELECTED PRESENTATIONS

*The following list of technical presentations **excludes** conference presentations of papers, presentations at committee meetings, and meetings related to normal office duties at Clemson:*

"Torque Control of Single Phase Induction Motors, " IEEE Power Engineering Society, Atlanta Section, (May 1989).

"Power by Light for Fiber to the Home Applications - A Technology Assessment," Center for Computer Communications Systems Annual Conference, Clemson University, September, (1992).

"Power by Light: The State of the Art for Technology," final research presentation BellSouth Telecommunications, Atlanta, GA, (February 1993).

"Harmonics Caused by DC Motor Drives," Summer CUEPRA Meeting, Florence, SC, (July 1994).

"Sag Generator and DC Drive Ridethrough," Duke Power Company, Charlotte, NC, (September 1994).

"Adjustable Speed Motor Drives: State of the Art and Research Opportunities," IEEE Student Branch -- Research Seminar Series, Clemson University, (September 1994).

- “Effect of Load Dynamics on Ride-Through Behavior of Adjustable Speed Drives,” Power Quality Interest Group, 1996 IEEE Power Engineering Society Winter Meeting, Baltimore MD, (February 1996).
- “Task 26: Voltage Sag Ride-Through Characterization of ASDs with Varying Process Conditions,” invited presentation, Power Electronics Applications Center, Knoxville, TN, (March 1996).
- “Matching DVR Performance and Sizing to Waveform Correction,” research seminar, Westinghouse Electric Co., Orlando FL, (July 1996).
- “System and Customer Impact: Considerations for Series Custom Power Devices,” invited presentation, Custom Power Task Force, 1996 IEEE Power Engineering Society Summer Meeting, Denver CO, (August 1996).
- “Waveform Analysis Using a New Technique: Missing Voltage,” a presentation to the IEEE working group on standard P1159-2 (power quality characterization), New York, (February 1997).
- “Impact of Voltage Sags on DC Motor Drives: Identification and Mitigation Techniques,” invited presentation to the SCC-22 Power Quality Interest Group at the IEEE Power Engineering Society Summer Meeting, Berlin, Germany, (July 1997).
- “Effect of Phase Shift During Voltage Sags on Rectifier Front-End Devices,” invited presentation to the SCC-22 Power Quality Interest Group at the IEEE Power Engineering Society Winter Meeting, Tampa FL, (February 1998).
- “Power Quality Event Characterization,” EPRI PQA '99 Conference, Charlotte NC, with Larry Morgan (Duke Power), Dan Sabin (Electrotek Concepts), and Arshad Mansoor (EPRI-PEAC), (June 1999).
- “IEEE Standard 1159: Overview and Status Update,” EPRI Power Quality Interest Group, Kansas City MO, (April 2000).
- “Power Quality Solutions for Industrial Automation Equipment,” presented to engineers on the Power Quality Issues Forum Steering Committee at the Clemson Power Quality and Industrial Applications Lab, (Sept. 2000).
- “Missing Voltage Analysis Using a Rectifier Reference: Another Method to Evaluate Voltage Disturbances,” invited presentation to the Power Quality Interest Group, IEEE Power Engineering Society Winter Meeting, Columbus OH, (Feb. 2001).

- “Voltage Disturbance Detector for Mitigating Power Quality Events,” invited presentation to the Power Quality Interest Group, IEEE Power Engineering Society Summer Meeting, Vancouver BC Canada, (July 2001).
- “Voltage Disturbance Detector for Mitigating Power Quality Events,” presented to engineers on the Power Quality Issues Forum Steering Committee at the Clemson Power Quality and Industrial Applications Lab, (Sept. 2001).
- “Power Quality,” a seminar for the Clemson University IEEE Student Chapter, (October 2001).
- “Electronic Motor Protectors: Sensitivity to Voltage Sags,” presented to Duke Power’s Power Quality Advance meeting, Charlotte NC, (February 2002).
- “Transient Power Quality Events: An Overview of Their Characterization and Their Impact On Industrial Loads,” IEEE Piedmont Section, Greenville SC, (April 2002).
- “Distributed Generation Issues” and “Inertial Effects of Rotating Loads on Ride-through,” Duke Power’s Power Quality Advance Meeting, Clemson SC, (April 2002).
- “Transient Power Quality Events: Why They Happen, What Problems They Cause, and How They Can Be Minimized,” IEEE Columbia Section, Columbia SC, (September 2002).
- “Stray Voltage,” presented for Hart Electric Membership Corporation at the Franklin County (GA) Farmer’s Association meeting, Lavonia GA, (February 2003).
- “An Overview of Adjustable Speed Drives,” IEEE Power Engineering Society Transmission and Distribution Conference tutorial, Dallas TX, (September 2003).
- “Power Quality and the End User: An Overview of PQ Problems and Solutions,” Progress Energy Executive Forum on Energy, Raleigh NC, (October 2003).
- “Forensic Analysis: Did The Electric Utility Cause My Equipment To Fail?,” Electric Power Research Institute (EPRI) Power Quality Interest Group Meeting, Wrightsville Beach NC, (October 2003).
- “Power Quality and Reliability: Strategies and Solutions for Business,” Progress Energy South Carolina Executive Forum on Energy, Florence SC, (August 2004).
- “Power Quality and Reliability: Strategies and Solutions for Sensitive Loads,” Progress Energy North Carolina Executive Forum on Energy, Raleigh NC, (September 2004).
- “Some Thoughts on the Impact of Harmonic Loads on Neutral-to-Earth Voltage,” Duke Power’s Power Quality Advance Meeting, (October 2004).

- “Stray Voltage,” Clemson University IEEE Student Branch, (April 2005).
- “University-Industry Partnerships: Experiences at Clemson University,” International Conference on Industry-Academia Collaboration: Opportunities and Challenges,” Ansal Institute of Technology, Gurgaon, Haryana, India, (March 2006).
- “An Overview of Adjustable Speed Drives,” IEEE Power Engineering Society Transmission and Distribution Conference tutorial, Dallas TX, (May 2006).
- “The IADD: Impedance-Based Arc Flash Determination Device,” Duke Power Power Quality Advance Meeting, (August 2006).
- “Professional Engineering Licensure: An Overview,” for Theta Tau, Professional Engineering Fraternity, Clemson University, (November 2006).
- “The IADD: A Device to Improve Accuracy of Arc Flash Hazard Assessments in Commercial and Industrial Facilities,” a seminar for the Allen Paulson College of Science and Technology, Georgia Southern University, (February 2007).
- “Lamp Flicker Reduction using Capacitive Compensation,” EPRI PLC Meeting, Manassas/Washington DC, (September 2007).
- “General Electric Technology Tutorial,” Presentation to Administrative Law Judge Hon. Carl Charneski, US International Trade Commission, Investigation No. 337-TA-641, *Certain Variable Speed Wind Turbines*, Washington DC, (April 29, 2009).
- “Simulated Grid on the Clemson University Wind Turbine Drive Train Test Facility”, multiples presentations at Vestas (Aarhus, Denmark), Siemens (Brandenburg, Germany), and at the Technical Advisory Board meeting, Charleston, SC, September – October 2010.
- “Simulated Power Grid at the Clemson University Restoration Institute”, Duke Energy Corporation, January 2011.
- “Innovation Ecosystem from a Provost’s Perspective,” given on behalf of Virginia Tech Provost M. G. McNamee, American Public and Landgrant University Annual Meeting, Denver CO, October 2012.
- “Models for Study Abroad,” panel session at 16th Annual Colloquium on International Engineering Education, Lexington KY, November 2013.
- “Integrating Study Abroad into the Curriculum: A Dean’s Perspective,” IIE Global Engineering Education Exchange Annual Meeting, Nanyang Technological Institute, Singapore, May 2014.

“Educating the 21st Century Engineer”, invited keynote speech at the Duke Energy Engineer’s Day, Raleigh NC, March 2015.

“Multi-Megawatt Hardware-in-the-Loop Grid Emulation,” Luleå University of Technology, Skellefteå Sweden, June 2016.

“Constraints Facing Faculty and Administration for Curricular Reform in Engineering,” Center for Advanced Power Engineering Research meeting, Charlotte NC, October 2016.

“Clemson University Power Engineering Curriculum,” EPRI GridEd Tech Transfer meeting, Dallas TX, April 2017.

“Achieving a Return on Investment in Higher Education & Scientific Research: Leveraging Industry Engagement,” The Global Forum for Higher Education and Scientific Research: Present and Future, invited speaker Ministry of Scientific Research, Al Masa New Capital, Cairo Egypt, April 2019.

“Power Quality,” Short Course Module for the Center for Advanced Power Engineering Research (CAPER), Charleston SC, June 2019.

“Excelling as an Educator and Academic Administrator,” Panel Session 19PESGM3068, Paths to Success in Academic Careers in Power & Energy, IEEE Power and Energy Society, August 8, 2019.

“Fostering Resilience Using a Consortium-Based International Student Exchange Model,” with S. Jons (IIE) and V. Misquita (Illinois Tech), Annual Colloquium on International Engineering Education, November 2021.

“Global E3: A Resilient International Consortium for Fostering Student Mobility,” Asia Technological Universities Network (ATU-Net) Virtual University Presidents Forum, presentation and roundtable discussion for session “Brave New World of Higher Education: Realities and Vision”, sponsored by University of Technology Malaysia, November 2021.

PATENTS AND INVENTION DISCLOSURES

US Patent 9651629, “Hardware-In-The-Loop Grid Simulator System and Method”, J. C. Fox, E. R. Collins, and N. Rigas, issued 5-16-2017. This patent was the result of the Duke Energy eGRID development at the Clemson University Restoration Institute.

US Patent 8362789, “Impedance-based arc fault determination device (IADD) and method”, E. R. Collins, T. L. Smith, and R. E. Emanuel (Duke), issued January 29, 2013. This patent was the result of a research contract with Duke Energy Corporation.

US Patent 7598751, “Impedance-based arc fault determination device (IADD) and method”, E. R. Collins, T. L. Smith, and R. E. Emanuel (Duke), issued Oct 6, 2009. This patent was the result of a research contract with Duke Energy Corporation.

"Single-phase Capacitive Voltage Dip Compensator," Invention Disclosure. Inventors: J. C. Fox and E. R. Collins. This invention was the result of a research contract with the Electric Power Research Institute (EPRI), August 2008.

Flicker Reduction Device for Heatpumps and Airconditioners. Invention Disclosure. Inventors: J. C. Fox, E. R. Collins, and R. L. Langley (EPRI). This invention was the result of a research contract with the Electric Power Research Institute (EPRI), Provisional Patent filed September 2011.

A Variable Fault Reactance Device for Controlled Low Voltage Ride Through Testing. Invention Disclosure, 2011; Inventors: J. C. Fox and E. R. Collins.

Voltage Disturbance Detector. Invention Disclosure. Inventors: E. R. Collins and N. Youell. This invention was the result of a research contract with Duke Energy Corporation. This was based on research and MS thesis of Nathan Youell. (2001)

Dynamic Voltage Restorer. Invention Disclosure. Inventors: E. R. Collins and H. J. Kim. This invention was the result of a research contract with Duke Energy Corporation. This was based on research and MS thesis of Hyung Joon Kim. (2000)

SPONSORED RESEARCH

“A Graphics Interface for a Computer-Based Interactive Instructional Program for Power Engineering Education,” Clemson University Teaching Award, PI, \$2,000, (1991).

“Power by Light: The State of the Art for Telephony,” BellSouth Telecommunications Co-PI, \$10,000, (June 1992).

“Power by Light for PCS Microcell Applications,” BellSouth Telecommunications, Co-PI, \$15,000, (July 1993).

“Controlling Chaotic Behavior of Fluidized Bed Combustors,” DOE and SC Energy R&D Center, Co-PI, \$7,950, (1993-94).

“Improving the Ride-Through Capability of DC Motor Drives in Extruder Applications,” Duke Power Company, PI, \$37,285, (1993).

“Improving the Ride-Through Capability of DC Motor Drives: A Continuation,” Duke Power Company, PI, \$27,743, (1994).

- “An Improved Sag Generator with Unbalanced Sag Capability,” Duke Power Company, PI, \$79,554, (1995).
- “An Improved Sag Generator with Unbalanced Sag Capability – Project Continuation”, Duke Power Company, PI, \$80,187, (1996).
- “Assessment of Dynamic Voltage Restorer Operation on the Power Distribution System and Industrial Loads,” Duke Power Company, Co-PI, \$38,406, (1995).
- “Assessment of Dynamic Voltage Restorer Operation on the Power Distribution System and Industrial Loads – Project Continuation,” Duke Power Company, Co-PI, \$98,360, (1996).
- “A Study to Increase Ridethrough Performance for DC Motors During Voltage Sags,” Duke Power Company, Co-PI, \$50,224, (1995).
- “Process-Specific Voltage Sag Characterization,” Electric Power Research Institute (EPRI), PI, \$150,329, (1997).
- “Overvoltage Clamping Circuit for AC Adjustable Speed Drives,” Duke Power Company, Co-PI, \$39,458, (1997).
- “Series Compensation Device Studies: Phase 3,” Duke Energy Corporation, PI, \$50,000, (1998).
- “Mechanical and Electrical Inertia Interactions During PQ Events,” Duke Energy Corporation, PI, \$49,998 (1999).
- “PQ Event Translation – Service Entrance to Equipment Sensor,” Duke Energy Corporation, PI, \$50,000, (1999).
- “Evaluation of PQ Implications on Power and Communication Wire Systems,” Duke Energy Corporation, Co-PI, \$64,994, (1999).
- “Extension to Evaluation of PQ Implications on Power and Communication Wire Systems” Duke Energy Corporation (Duke Power Company), Co-PI, \$70,000, (2000).
- “Power Quality Issues Related to Ridethrough of Electrically Driven Mechanical Systems and Distributed Generation,” Duke Energy Corporation, Principal Investigator, \$140,000, (5/2001).
- “Distributed Generation and Power Quality: Investigation of Impact of DG on the Electrical Distribution System and Industrial Process Devices,” Duke Energy Corporation, Principal Investigator, \$145,000, (7/2002 – 7/31/2004).

“Power Quality Investigations on the Interface Between the Utility Power System and Customer Loads,” Sponsored by Duke Energy Corporation (Duke Power Company), \$75,000, (1/1/2004 - 6/30/2005).

“Development of PQ Solutions for Advanced Industrial Automated Systems Sponsored by Duke Energy Corporation (Duke Power Company),” Co-PI, \$145,000, (1/1/2002 - 6/30/2005).

“Diagnostics and Treatment of Electric Wiring Systems in Aging Aircraft,” NASA – SC EPSCOR, Co-PI, \$30,000, (2/2005 – 5/2006).

“Investigations on Power Distribution Systems: Fault Duty Analysis for Arc Flash Studies and Stray Voltage Investigations,” Duke Energy Corporation, \$75,000 + equipment donations, (9/2005 – 12/2007).

“Multi-Institutional Mechatronic and Material Handling Laboratories – Course Development and Student Collaboration,” National Science Foundation CCLI, Co-PI, with Clemson Mechanical Engineering, Industrial Engineering and Greenville Technical College MET department, \$199,961 (2007 - 2009).

“Voltage Flicker Reduction Using Reactive Power Compensation on Residential Heat Pumps – Feasibility Study,” Electric Power Research Institute (EPRI), \$20,000, (8/2007 – 12/2007); Phase II \$25,000 (6/2008 – 12/2008).

“Obsolescence Planning of Electronic Energy Meters –Phase 1,” Electric Power Research Institute (EPRI), \$20,000, (9/2007 – 8-2008).

“Prototype Development of a Voltage Flicker Mitigation Device for Electric Heat Pumps and Air Conditioners, Phase 3,” Electric Power Research Institute (EPRI), \$21,275, (12/2009 – 8/2011).

“15 MW Hardware-in-the-loop Electric Grid Simulator,” funded by US Dept. of Energy, Duke Energy, Santee Cooper, SCANA/SCE&G, others, with Dr. Nick Rigas and J. C. Fox, Co-PI, ~\$13M, (2012-2014).

“The Logistics of Moving a Large Extra-High-Voltage Power Transformer for Sparing,” Savannah River National Laboratory, \$308,500, November, 2019.

“Megawatt Scale, Multi-Source Heat Recovery System with a Flexible Grid Interconnect,” US Dept. of Energy – Advanced Manufacturing Office (DOE AMO), DE-EE0009423, \$5.85M, (9/2021 – 11/2024). (PI)

GRADUATE STUDENT ADVISING (as Major Professor)

Doctoral Graduates

- Tunaboyle, N. S., "Electromechanical Performance of Induction Motor/Drive Systems Subjected to Voltage Sags," (May 2002).
- Jiang, J., "Elevated Neutral-to-Earth Voltage in Distribution Systems with Harmonics," (December 2006).
- Fox, J. C., "15 MW Simulated Power Grid with Hardware-in-the-Loop Capability," (December 2013).
- Singh, G. K., "Characterizing Light Output Variations from Solid State Lighting Due to High Frequency Electromagnetic Interference," (May 2017).
- Rangarajan, S. S., "Efficacy of Smart PV Inverter as a Strategic Mitigator of Network Harmonic Resonance and a Suppressor of Temporary Overvoltage Phenomenon in Distribution Systems," (August 2018).
- Tooryan, F., "A Techno-Economical Optimization of Distributed Generators in Distribution Systems," (May 2020).
- Ahmadi, Afshin, "Accelerating Power Flow Studies Through Parallel Computing," (December 2020), co-advisor (with Dr. M. Smith).

Masters Graduates – Thesis Option

- M. Daemi-Avval, (MS) "Active Ripple Torque Compensation of Single-Phase Induction Motors by Application of a Triple Frequency Current Source to the Auxiliary Winding," (December 1990).
- Boyd, P. B., (MS) "Evaluation of the Double Revolving Field Theory for Single-Phase Induction Motors Models," (August 1992).
- Huang, Y., (MS) "A Programmable Dynamometer for Testing Rotating Machinery," (May 1993).
- Camacho, S. M., (MS) "A Harmonic Model for Controlled Rectifier-type DC Motor Drives Operating in the Continuous and Discontinuous Current Mode," (May 1994).
- Middlekauff, S. W., (MS) "Using a Sag Generator to Identify Power Quality Problems in Industry," (May 1996).
- Zapardiel, F., (MS) "A Voltage Insertion Technique for Generating Unbalanced Voltage Sags," (July 1997).

Rice, J., (MS) "Improving the Ride-Through Capabilities of DC Motor Drives," (August 1997).

Sahpolat, M. (MS) "Optimization of the field control of an Unbalanced Sag-Generator," (December 1997).

Langley, R., (MS) "A Controllable Dynamic Dynamometer for Testing Rotating Machinery," (December 1997).

Chaney, P., (MS) "Characterization of Voltage Sags," (August 1998).

Wang, H., (MS) "An Algorithm to Simulate the Propagation of Voltage Sags in an Industrial Power System," (August 2000).

Kim, H-J., (MS) "A New Approach to Correct Power System Voltage Disturbances using a Six Pulse Inverter," (December 2000).

Youell, N., (MS) "Development of a Real-Time, Three-Phase, Cost-Effective Voltage Disturbance Detector," (August 2001).

Jiang, J., (MS) "Behavior and modeling of distributed generation under fault conditions," (December 2003).

Barnett, R., (MS) "A scaled electric power distribution system for testing transients and voltage regulation equipment," (May 2003).

Baier, A., (MS) "The Development of an Automated Motor-Generator Lab Station for Use in Motor Control and Power Electronic Studies," (August 2003).

Ravishunkar, A., (MS) "The development of an electronically driven tap changer for voltage regulation and power quality studies on a distribution network analyzer," (May 2005).

Gupta, A., (MS) "Implementation of a scaled synchronous distributed generator and its controls on a distribution network analyzer," (August 2005).

Stout, G., (MS) "Air core inductors for distribution line modeling in a scaled power system," (August 2005).

Yocco, R. (MS) "Advanced workstations and laboratory experiments for teaching electric machines, power electronics, and motor drives, (August 2005).

Smith, T. (MS), "The IADD: A Device to Improve Accuracy of Arc Flash Hazard Assessments in Commercial and Industrial Facilities," (December 2007).

Chaluvadi, H. (MS), "Obsolescence Testing of Electronic Energy Meters," (August 2008).

Fox, C. (MS) "Residential Lamp Flicker Reduction Caused by Heat Pump Starting," (December 2008)

Fain, D. (MS), Bi-directional battery chargers for Plug-In Hybrid Electric Vehicles, (May 2009).

Shirley, J. (MS), “Development of a Multidisciplinary Material Handling Laboratory,” (December 2009)

May, C. (MS), Flicker in Compact Fluorescent Lamps due to Voltage Fluctuations (May 2010).

Singh, G., (MS), “The Influence of the Auxiliary Winding Resonant Circuit on the Harmonic Response of a Single-Phase Induction Motor,” (December 2012).

Undergraduate Research Students (with thesis)

Shirley, J. (BS), “Harmonic Reaction of Single-Phase Induction Motor to 3rd Harmonic Voltage Distortion,” (December 2007).

Current Graduate Student Advising as major professor

Esin, I. (PhD), committee chair

LaFlair, N. (PhD) co-advisor, committee member

TEACHING

Courses Taught

Clemson University

ECE 202	Electric Circuits I	Su92, part Sp93, F97, F98, Sp00, F00, Sp03, Sp04, F04, Sp05, F05, Sp06, F06, F07
ECE 262	Electric Circuits II (formerly ECE 301)	F93, Sp02, Sp08
ECE 301	Electric Circuits II	Su91, Sp92, F92
ECE 307	Electrical Engineering	F90, Su02, Su 05, Su06, Su07, Su08
ECE 308	Electronics and Electromechanics	Sp91
ECE 360/3600	Electric Power Engineering	Sp90, Su90, Su91, F91, Su92, Su93, part F93, F94, F96, F99, F01, F02, F03, Su 04, Su 05, Su06, Su07, Su08, Su09, Sp15, Su15, F15, Sp16, Su16, F16, Sp17, Su17, F17, Sp18, Su18, F18, Sp19, Su19, Sp20, Su20, Sp21, Su21, Su22
ECE 405/496	IEEE Car Project Team	F97, Sp98, Sp99, Sp00, F00, Sp01, Sp02, Sp03, Sp04, Sp06
ECE 412	Electric Machinery Laboratory	F89, F99
ECE 419/619	Electric Machinery	Sp90, Sp91, Sp92, Sp93, Sp94, Sp95, Sp96, Sp97

ECE 419/619	Electric Motors and Drives	Sp98, Sp99, Sp00, Sp01, Sp02, Sp03, Sp04, Sp05, Sp06, Sp07, Sp08
ECE 434/634	Power Electronics	F89, F90, F91, F92, F93, F94, F95, F96
ECE 802	Electric Motor Control	F90, Sp93, Sp95, Sp97, Sp99, F01, F03, F05, F07, S09, F11
ECE 893	Advanced Power Electronics	F98, F00, F02, F04, Sp10
Creative Inquiry (Undergraduate Research) ECE 399/499		Sp09, F09, Sp10
Online Courses:		
	ECE 360 (Su 2004, Su 2005, Su2006, Su 2007, Su 2008, Summer 2009, Su 2010, Su 2015, Su 2016, Su 2017, Su 2018, Su 2019, Su 2020, Su 2021)	
	ECE 307 (Su 2005, Su2006, Su2007, Su 2008)	

Georgia Institute of Technology

EE 3700	Electric Circuits	Wtr 85, Sp85
EE 3710	Electronic Circuits and Machines	Wtr 86
EE 3701	Electric Circuit Analysis	Sp 86
EE 3702	Electronic Devices and Systems	Wtr 87
EE 3703	Electric Machines and Power	Su 87

New Courses Developed

ECE 419/619, Electric Machines and Drives, New Course Developed after Curriculum Revision (1998); Laboratory exercises (2002 – 2006)

ECE 893, Advanced Power Electronics (1998)

ECE 307, Basic Electrical Engineering, Online Course (2005)

ECE 360, Power Engineering, Online Course (2004). This was the ECE department's first offering of a completely online, asynchronous undergraduate course.

Laboratory Development

Rockwell Automation Design Laboratory (instructional and research)

Electric Circuits Laboratory (instructional)

UNIVERSITY AND PUBLIC SERVICE

Continuing Engineering Education (Courses Developed and Taught)

"PE Review Series: Practice-Oriented Circuit Analysis," Clemson University Continuing Engineering Education (Summer 1992 - 2000, Spring 1993 – 2002, Summer 2003, Spring 2005 and 2006, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Spring 2012, Fall 2012).

"PE Review Series: Power Systems I," Clemson University Continuing Engineering Education, (Summer 1999 - 2000, Spring 2000 – 2002, Summer 2003, Spring 2005 and 2006, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Spring 2012, Fall 2012).

"PE Review Series: Power Systems II," Clemson University Continuing Engineering Education (Summer 1999 - 2000, Spring 2000 – 2002, Summer 2003, Spring 2005 and 2006, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Spring 2012, Fall 2012).

"PE Review Series: Electric Machinery," Clemson University Continuing Engineering Education, (Summer 1992 - 2000, Spring 1993 – 2002, Summer 2003, Spring 2005 and 2006, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Spring 2012, Fall 2012).

"Design of Industrial Electrical Power Systems, 15kV Class," Two three-day in-house courses for Westinghouse Electric Company, Greenwood SC. Arranged through Clemson University's Continuing Engineering Education, (June 14-16, 1993 and June 21-23, 1993).

"Principles of Power Electronics, Electric Machines, and Adjustable Speed Drives," a one-day seminar for Clemson University's Continuing Engineering Education *Engineer's Short School*, (May 14, 1993).

"Power Electronics, Adjustable Speed Drives, and Electric Motors" a three-day short course with lecture and laboratories for utility power quality engineers, Duke Power Company, Clemson University, (August 3 - 5 and 22 - 24, 1994, and March 20-22, 1995).

"Motor and Variable Speed Drives Applications," a two day short course for the Fluor Daniel Corporation, Greenville SC, (October 24-25, 1996).

"Power Quality, Equipment Susceptibility, and Ride-Through Solutions," a three-day laboratory intensive short course for industrial customers of the Duke Power Company (with R. L. Morgan), taught in the Clemson PQIA laboratory, (April 1997, September 1997, September 1998, April 1999, August 1999, November 1999, August 2000, November 2000, November 2001, November 2002, November 2003).

"Basics of Electrical Engineering," a two-day short course providing an overview of electrical engineering for non-EEs, Clemson University Office of Professional

Development, *public offerings*: (October 1997, April 1998, October 1998, April 1999, October 1999, January 2000, May 2000 (Detroit), October 2000, January 2001, January 2002).

“Power Quality,” a two-day short course on electrical utility power quality, and the impact of poor power quality on industrial and commercial facilities. Offered through Clemson University’s Office of Professional Development, *public offerings*: (February 1999, September 1999, February 2000 (Atlanta), September 2000). Taught with David Lubkeman (1999) and Mike Bridgwood (2000).

“Power Quality,” a two-day in-house seminar for Technical Staff at Marconi, Belleville IL, taught at Marconi’s facility (November 2000).

“Basics of Electrical Engineering and Electronics,” a two-day short course for Molex, Inc technical staff. Taught at Molex’s Naperville IL facility (February 2001).

“Power Quality,” two one-day short courses for Florida Power and Light, Miami FL (May 2001).

“Power Systems Review,” a two-day short course for South Carolina Electric and Gas, Columbia SC, (June 2001).

“Optimizing Adjustable Speed Drive Performance,” Duke Power Workshop Series/ EPRI Power Quality University, Charlotte NC (with Larry Morgan of Duke Power), (August 2001).

“Optimizing Industrial Process Ride-Through,” Duke Power Workshop Series, Charlotte NC, (with Larry Morgan of Duke Power), (December 2001).

"PE Review Series: “Practice-Oriented Circuit Analysis,” “Power Systems I,” “Power Systems II,” and “Electric Machinery,” taught for Clemson University Continuing Education for Duke Power Company, Oconee Nuclear Station (Summer 2002 and Summer/Fall 2006).

“Basics of Electrical Engineering,” a two-day short course for Columbia Gas Transmission Company technical staff. Taught at Columbia Gas Transmission’s facility, Charleston WV (February 2003).

“OSHA Electrical Safety Training for Qualified and Unqualified Personnel,” a one-day training seminar for Clemson University employees, taught for Clemson University’s Department of Environmental Health and Safety, (March 25 and 27, 2003).

“Power Quality,” a one-day short course for the Southeastern Electric Exchange PQ&R committee, Clearwater Beach FL, (April 2003).

- “Power Quality: an overview of power quality events, their effect on equipment, and mitigating solutions,” a two-day short course for technical staff and management at Progress Energy, taught in Raleigh NC, (May 2003).
- “Basics of Electrical Engineering,” a two-day short course for Westinghouse Savannah River Corporation technical staff. Taught at the WSRS facility in Aiken, SC (September 2003 and February 2004).
- “Power Electronics and Power Quality,” a one-day short course for Duke Power’s Power Quality technical staff, (August 2003).
- “Power Quality,” a one-half day short course for the Southeastern Electric Exchange substations committee, Williamsburg VA, (October 2003).
- “Ensuring Process Performance: Maximizing Ridgethrough for your System,” a one-day short course for Duke Energy Corporation, Charlotte NC, (October 2005).
- “Variable Speed Drives,” a two-day short course developed for Cryovac-SealedAir Corporation, Duncan SC, (May 2006).
- "PE Review Series: “Practice-Oriented Circuit Analysis," “Power Systems I,” “Power Systems II,” and “Electric Machinery," taught for Clemson University Continuing Education for Navy SPAWAR (Space Warfare and Systems Center), Charleston SC, (Spring 2008).
- “Electric Motors and Variable Speed Drives,” a two-day short course for Santee Cooper, Moncks Corner, SC, (June 2009).
- “Power Quality: an overview of power quality events, their effect on equipment, and mitigating solutions,” a one-day short course for technical staff and management at Santee Cooper, taught in Moncks Corner, SC, (June 2011).
- “Power Quality,” Short Course Module for the Center for Advanced Power Engineering Research (CAPER), Charleston SC, (June 2019).

EDWARD R. COLLINS, JR., Ph.D., P.E.

SIGNIFICANT CONSULTING EXPERIENCE (since 2000)

Duke Energy Corporation – Oconee Nuclear Station, Seneca SC (2002), root cause analysis of main switch failure.

Nelson Mullins Riley & Scarborough/Square D Company, Greenville SC (2002) analysis of circuit breaker failure; expert report and deposition.

Progress Energy, Raleigh NC (2003), forensic analysis of multiple single-phase motor failures.

Ward Law Firm/Fallon Luminous Industries, Spartanburg SC (2003), interaction of electronic ballasts (power supplies) and electrodes on dimming of argon/mercury lamps; expert report.

Robinson, Bradshaw and Hinson/Springs Industries, Rock Hill SC (2003 – 2004), York Printing & Finishing vs. Springs Industries. Energy analysis of a textile plant and expert witness; deposition and testified in court.

Wilson, Sonsini, Goodrich and Rosati/American Power Conversion (APC), Boston MA/Palo Alto CA, (2004), patent and technology review on uninterruptible power supplies related to potential patent infringement case; hardware examination and testing.

Vaux and Marchser/DelWebb, Bluffton SC (2005), investigation of underground power cable damage.

McCutcheon, McCutcheon & Baxter/Santee Cooper, Myrtle Beach SC (2005), forensic analysis of fire in an electronic control system due to alleged poor power quality; hardware examination and expert report.

Vinson & Elkins/General Electric, Austin TX (2008-2009), patent infringement expert witness and consulting for wind turbine generators and their power converters, US ITC case 337-TA-641, “*In the Matter of Certain Variable Speed Wind Turbines and Components Thereof*,” General Electric vs. Mitsubishi Heavy Industries. Expert reports and depositions; presented technology tutorial to ALJ; testified in court at ITC.

Santee Cooper, Moncks Corner, SC (2009), investigation of induced voltages on high voltage power lines.

Pentair/Sughrue Mion, PLC, expert witness and consulting for patent infringement case Pentair Water Pool and Spa vs. Hayward Industries, C.A. No. 5:11-CV-459, (2011 – 2018), related to power electronics and motor control. Multiple expert reports on 5 patents (main case plus IPR/re-examinations), multiple depositions for main case and *inter partes review*/IPRs. Also provided expert witness and consulting for the related patent re-examinations and IPRs for Pentair counsel Quarles & Brady (2013 – 2018).

Klarquist Sparkman, LLP, consulting on patent re-examination for technology related to electrical wind generators, expert report (2013 - 2014).

Paul Hastings, LLP (earlier in the case, McDermott, Will & Emery), expert witness and consulting for patent infringement case Fairchild Semiconductor vs. Power Integrations, C.A. No. 12-540-LPS, (2014-2015). Multiple expert reports, deposition, and testified at trial.

Jones Day, expert witness in patent infringement case Lufthansa Technik vs. Astronics (AES), 2:14-cv-01821-RSM, (2015 – 2016). Expert reports, deposition, and support for claim construction hearing related to aircraft power supplies.

Hovey Williams, LLP, expert witness in patent case, Lindsay Corporation vs. Valmont Industries. *Inter Partes Review* of Patent. Provided technical consultation, validity analysis, and expert report regarding power electronics/variable speed motor applications. (2016)

Harvey and Kulmala, LLC, expert witness in Jeffrey C. Till v. Orangeburg DPU and Jacob C. Till v. Orangeburg DPU, Case Nos. 2020-CP-38-0014 and 15. (2020 – present)

Quinn Emanuel Urquhart & Sullivan, LLP, expert witness in Wisk Aero LLC vs. Archer Aviation, Inc. Case NO. 3:21-cv-02450-WHO, (2020-2023). Multiple expert reports, declarations, technology review, depositions related to trade secrets and patent infringement.