

# Robert M. Cuzner

cuzner@uwm.edu

## **Education:**

*PhD. Electrical & Computer Engineering, University of Wisconsin-Madison, May 2013*

Dissertation: Discontinuous Conduction Mode Operation of Current Source Rectifiers

Secondary Research Area: Protection of DC Microgrids

Focus: Power Conversion and Power Electronics and Electric Machines; Minor: Electromagnetics  
Grainger Power Engineering Award, April 2013 (\$8000)

*M.S. Electrical & Computer Engineering, University of Wisconsin-Madison, August 1990*

Thesis: Application of Closed Loop Observers to Self-Sensing of Induction Machines

Focus: Power Electronics and Electric Machines and Controls

Wisconsin Power Electronics and Electric Machines Research Assistantship (\$13000 annually)

*B.S. Electrical & Computer Engineering, Brigham Young University, 1988*

Minor: Mathematics

## **Positions Held:**

*Director, Center for Sustainable Electrical Energy Systems, 2021-Present, **University of Wisconsin-Milwaukee** (<https://sites.uwm.edu/sees/>)*

*Site Director, GRid-connected Advanced Power Electronic Systems (GRAPES) National Science Foundation Industry/University Collaborative Research Center, 2021-Present, , **University of Wisconsin-Milwaukee** (<https://sites.uwm.edu/grapes/>)*

*Associate Professor, 2018-Present; Assistant Professor, 2014-2018, **University of Wisconsin-Milwaukee,***

**Research Areas:** Modular power electronics systems packaging and integration, wide band gap power semiconductor application to systems, virtual prototyping and multi-objective optimization of power electronic converters and power electronics based protection systems, electromagnetic compatibility, reliability, medium voltage DC systems, shipboard electrification, DC protection, microgrid protection, hybrid AC-DC microgrids, residential and community microgrids, military base microgrids, multiple electric vehicle ultra-fast charging stations, variable speed drives, power conversion system simulations, real-time Hardware-in-the-Loop (HiL), Controller Hardware-in-the-Loop (CHiL), Power Hardware-in-the-Loop (PHiL) based simulation systems.

**Teaching:** Electromagnetic energy conversion (electric machines, transformers, magnetic circuits), power electronics, analysis of motor controls and drives, Electromagnetic Interference (EMI) of Power Electronic Systems

**Advisement:** Average of 16 PhD and MS students are being advised while providing financial support for, on average, 8-10 graduate students

*Teaching Associate, University of Wisconsin-Madison, 2020-present*

Courtesy teaching professor appointment

Co-advisor and co-instructor, course on current source converters

*Research Associate, **Florida State University Center for Advance Power Systems**, 2019-present*

Courtesy research professor appointment

Support of real-time simulation platform

for electrified navy ships

*Part-Time Consultant and Owner, **Cuzner Power Conversion Consultants LLC**, 2019-present*

*Part-Time Consultant, **Leonardo DRS**, 2014-2019*

Supporting implementation power conversion based electrification of current Navy ships

*Staff Systems Engineer, **DRS Power and Control Technologies** , 2002-2014*

Developed power electronic building block approach for implementing highly electrified surface and submarine shipboard electrical distribution systems; developed power dense shipboard compatible drive systems; Ship system integrator for ship-building activities

*Principal Engineer, **Eaton Corporation**, 1993-2002*

Developed controls and power electronics hardware for surface and submarine power conversion and power distribution equipment; supervised internal research and development

*Development Engineer, Miller Electric Mfg. Co., 1990-1993*

Developed portable generator systems for welding applications

*Part-Time Consultant, Synchrotek, Inc. , 1991-992*

Developed tools for the design of portable brushless generators

*Research Assistant, University of Wisconsin-Madison, 1988-1990*

Developed self-sensing controls for induction motor drives using terminal voltage and current

### **Awarded Proposals:**

#### **Total Funding Received Since Start-Up (2014): \$3,645,342**

1. “Hybrid Energy Storage System (HESS) SBIR”, *U.S. Air Force* sub-contract received through **Badger Technologies**, Principal Investigator, \$169,000. Awarded currently being negotiated.
2. “DC Disconnect Switch SBIR”, *Naval Sea Command* sub-contract received through **Hepburn and Sons**, Principal Investigator, \$50,000, Award currently being negotiated.
3. “Advanced Filter Architecture for Successful Integration of Generation Wide Bandgap Power Semiconductors”, *Eaton Corporation*, Principal Investigator, \$50,000, Award currently being negotiated
4. “Robust Combat Power Energy Management Controls”, *Naval Sea Command* sub-contract received through the Electric Ship Research Consortium (**ESRDC**) at Florida State University Center for Applied Power Systems (**FSU-CAPS**), Principal Investigator, \$119,653. Awarded June 6, 2022
5. “Electric Ship Assets: Aging, Modeling, Reliability and Condition Assessment”, *Naval Sea Command* sub-contract received through the **ESRDC at FSU-CAPS**, Principal Investigator, \$63,229. Awarded June 6, 2022
6. “Zonal Nanogrids for Naval Bases”, *Department of the Navy Office of Naval Research, Naval Facilities (NAVFAC)* sub-contract through **Naval Postgraduate School**; Co-Principal Investigator; \$200,000, Awarded November 20, 2021
7. “Systems Engineering Research and Technology in Integrated Space Systems Concepts and Methodology”, *NASA* sub-contract through **University of Alabama Huntsville**; Co-Principal Investigator, \$30,000. Awarded November 20, 2021
8. “Medium Voltage Solid State Transformer”, *National Science Foundation*; GRAPES IUCRC, Principal Investigator; \$56,000. Awarded November 15, 2021.
9. “DURIP: FPGA-Based Real-Time Controller-Hardware-in-the-Loop System for Shipboard Survivability and Microgrid Resiliency Studies”, *Office of Naval Research*, Principal Investigator, \$128,440, Awarded on October 1, 2021
10. “Resilient MVAC/MVDC Distribution Systems”, *National Science Foundation*; GRAPES IUCRC, Principal Investigator, \$55,445. Awarded January 1, 2021
11. “Early Design Explorations of Shipboard Module and PEPDS based IPES Electrification”, *Department of the Navy Office of Naval Research*; Principal Investigator, \$450,000. Awarded June 30, 2020
12. “Extreme Power Conversion”, *Midwest Energy Research Consortium, Eaton Corp., DRS Leonardo*; Principal Investigator, \$75,000. Awarded February 15, 2020
13. “EMI Test and Characterization Facility”, *Economic Development Agency*; Principal Investigator; \$986,684. Awarded January 15, 2020
14. “Medium Voltage Solid State Transformer”, *National Science Foundation*; GRAPES IUCRC, Co-Principal Investigator; \$38,000. Awarded November 15, 2019.
15. “NSETTI: Energy Secure Hybrid AC/DC Microgrids for Naval Facilities with Distributed Energy Resources”, *Department of the Navy Office of Naval Research, Naval Facilities (NAVFAC)*; Co-Principal Investigator; \$118,250, Awarded June 1, 2019
16. “Medium Voltage Solid State Circuit Breaker”, *National Science Foundation*; GRAPES IUCRC, Principal Investigator; \$97,000. Awarded November 15, 2018.

17. "Multi-EV Ultra-Fast Charging Stations", *National Science Foundation*; GRAPES IUCRC, Principal Investigator; \$66,000. Awarded November 15, 2018.
18. "Extensive Comparative Study on High Power Inverters Using Various Switching Devices", *National Science Foundation*; GRAPES IUCRC, Co-Principal Investigator; \$61,016. 50% Awarded June 1, 2017.
19. "Base Expeditionary Airfield Resources Technology Evaluation and Integrated Lab". **U.S. Air Force** sub-contract through **Eaton Corporation**, Co-Principal Investigator, \$100,000. Awarded on May 1, 2017
20. "Development of Protective Relaying Methods for Microgrids", *National Science Foundation*; GRAPES IUCRC, Principal Investigator; \$69,400. Awarded March 1, 2017.
21. "Milwaukee Garden Homes Microgrid: An Energy-Sharing Cooperative and Living Laboratory Accelerating Minorities toward the New Energy/Information Based Economy", **Social Compact Grants Program, University of Wisconsin-Milwaukee**, Principal Investigator; \$28,000. Awarded August 15, 2016
22. "Tools for Shipboard Electrical System Studies", *Department of the Navy Office of Naval Research*; Principal Investigator; \$521,333. Awarded July 15, 2016.
23. "Fault Protection in a DC Community Microgrid", *National Science Foundation*; GRAPES IUCRC, Principal Investigator; \$39,999. Awarded: February 4, 2016.
24. "Zonal Power System Modeling", *DRS Power and Control Technologies*; Principal Investigator; \$43,982. Awarded: August 1, 2015.
25. "MVDC Architecture and Fault Protection Study Phase I", *Department of the Navy Office of Naval Research* sub-contract through **DRS Power and Control Technologies**; Principal Investigator; \$28,911.23. Awarded: October 14, 2014.

#### **Selected Pre-Academic Awarded Proposals:**

26. "Low Horsepower Drive Development Program", Internal Research and Development, **DRS Technologies, Inc.**; Principal Investigator; September 2012-Present (Note that I used a part of this funding for my PhD research)
27. "Phase I-Fan Coil Assembly", N65540-10-R-0050, *Naval Surface Warfare Center Carderock*; Variable Speed Drive Technical Proposal Lead, Engineering Bid Lead and Principal Investigator; Included partnership with University of Wisconsin-Madison and two DRS sister divisions; Awarded October 2011 (Note that I used a part of this funding for my PhD research)
28. "Integrated Fight-Through Power System for Ship Service Distribution", *Bath Iron Works*; Technical Proposal Lead, Engineering Bid Lead and Principal Investigator; Largest contract every awarded to DRS Power and Control Technologies; Awarded March 2006
29. "Mini Demonstrator Unit (Unmanned Underwater Vehicle)", *Electric Boat*; Technical and Program Proposal Lead, Engineering Bid Lead and Principal Investigator; Awarded September 2001
30. "Integral Firepump Motor Drive (Shipboard Variable Speed Drive)", *Kaman Aerospace*, Technical and Program Proposal Lead, Engineering Bid Lead and Principal Investigator; Awarded November 2000
31. "Integrated Power System", *Naval Surface Warfare Center Carderock*; Technical and Program Proposal Lead, Engineering Bid Lead and Principal Investigator; Awarded January 2000

#### **Books and Book Chapters:**

1. *Medium Voltage DC System Architectures*, edited by B. Grainger and R. De Doncker, "Chapter Two: Power Electronic Converters Impacts on MVDC Architectures", R. Cuzner, J. B. He, Institution of Engineering and Technology (IET), December 17, 2021
2. *Variability, Scalability and Stability of Microgrids*, published by the Institution of Engineering and Technology, 2019, ISBN 978-1-78561-693-8. "Chapter 12: Microgrid protection", Robert M. Cuzner, Siavash Beheshtaein and Farzad Banihashemi, pp. 396-453

### **Peer-Reviewed Publications:**

3. S. Malekshah, F. Banihashemi, H. Daryabad, N. Yavarishad, and R. Cuzner. "A Zonal Optimization Solution to Reliability Security Constraint Unit Commitment with Wind Uncertainty." *Computers and Electrical Engineering* vol. 99, 2022 Apr 1.
4. M. Vygoder, G. Oriti, J. Gudex, T. Tencate, A. L. Julian, R. Cuzner, "Comparison of Voltage Abnormality Detection Methods for Single-Phase Inverters to Meet the Requirements in IEEE Standard 1547-2018," *IEEE Transactions on Industry Applications*. 2021 Jun 2
5. R. Cuzner, L. Fan. "On Converter Topology, Control, and Modeling", *IEEE Electrification Magazine*. 2021 Jun 4;9(2):2-4.
6. M. Karami, T. Li, R. Tallam, R. Cuzner,. "Thermal characterization of SiC modules for variable frequency drives", *IEEE Open Journal of Power Electronics*. 2021 Apr 26;2:336-45.
7. S. Ozdemi, N. Altin, A. Nasiri, R. Cuzner, "Review of Standards on Insulation Coordination for Medium Voltage Power Converters," *IEEE Open Journal of Power Electronics*. 2021 Mar 12, vol. 2, pp. 236-49.
8. R. M. Cuzner, J. M. Guerrero. "Guest Editorial Special Issue on DC Protection," *IEEE Journal of Emerging and Selected Topics in Power Electronics*. 2021 Jun 1;9(3):2473-5.
9. M. Vygoder, M. Milton, J. D. Gudex, R. M. Cuzner, A. Benigni, "A hardware-in-the-loop platform for DC protection", *IEEE Journal of Emerging and Selected Topics in Power Electronics*. 2020 Aug 19, vol. 9(3):2605-19.
10. K. Palaniappan, W. Sedano, M. Vygoder, N. Hoeft, R. Cuzner and J. Shen, "Short Circuit Fault Discrimination Using SiC JFET Based Self-Powered Solid State Circuit Breakers in a Residential DC Community Microgrid," in *IEEE Transactions on Industry Applications*, May 2020
11. S. Beheshtaein, M. Savaghebi, R. M. Cuzner, S. Golestan and J. M. Guerrero, "Modified Secondary-Control-Based Fault Current Limiter for Inverters," in *IEEE Transactions on Industrial Electronics*, vol. 66, no. 6, pp. 4798-4804, June 2019
12. S. Beheshtaein, R. M. Cuzner, M. Forouzesh, M. Savaghebi, J. M. Guerrero. "DC microgrid protection: A comprehensive review". *IEEE Journal of Emerging and Selected Topics in Power Electronics*. March 2019
13. S. Beheshtaein, R. Cuzner, M. Savaghebi, S. Golestan and J. M. Guerrero, "Fault location in microgrids: a communication-based high-frequency impedance approach," in *IET Generation, Transmission & Distribution*, vol. 13, no. 8, pp. 1229-1237, 23 4 2019
14. S. Veerapaneni, K. Palaniappan, R. M. Cuzner, "Analysis of solar and battery requirements for hybrid DC/AC powered households in the USA". *Energy Efficiency*. pp. 1-9, January 2019
15. Palaniappan K, Veerapaneni S, Cuzner RM, Zhao Y. "Viable residential DC microgrids combined with household smart AC and DC loads for underserved communities". *Energy Efficiency*. pp. 1-7. December 2018
16. R. Cuzner, "The Socially Responsible Microgrid". *IEEE Electrification Magazine*. November 2018;6(4):2-5.
17. S. Beheshtaein, R. Cuzner, M. Savaghebi, J. M. Guerrero. "Review on microgrids protection". *IET Generation, Transmission & Distribution*. Feb 2018;13(6):743-59.
18. A. N. Lemmon, R. Cuzner, J. Gafford, R. Hosseini, A. D. Brovont, M. S. Mazzola. "Methodology for characterization of common-mode conducted electromagnetic emissions in wide-bandgap converters for ungrounded shipboard applications". *IEEE Journal of Emerging and Selected Topics in Power Electronics*. June 2017;6(1):300-14.
19. R. M. Cuzner, R. Soman, M. M. Steurer, T. A. Toshon and M. O. Faruque, "Approach to Scalable Model Development for Navy Shipboard Compatible Modular Multilevel Converters," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 5, no. 1, pp. 28-39, March 2017
20. R. Soman, M. M. Steurer, T. A. Toshon, M. O. Faruque and R. M. Cuzner, "Size and Weight Computation of MVDC Power Equipment in Architectures Developed Using the Smart Ship Systems Design Environment," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 5, no. 1, pp. 40-50, March 2017

21. R. M. Cuzner and V. Singh, "Future Shipboard MVdc System Protection Requirements and Solid-State Protective Device Topological Tradeoffs," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 5, no. 1, pp. 244-259, March 2017
22. D. Drews, R. M. Cuzner and G. Venkataramanan, "Operation of Current Source Inverters in Discontinuous Conduction Mode," in *IEEE Transactions on Industry Applications*, vol. 52, no. 6, pp. 4865-4877, Nov.-Dec. 2016
23. R. M. Cuzner, "Does DC Distribution Make Sense?" in *IEEE Electrification Magazine*, vol. 4, no. 2, pp. 2-3, June 2016
24. Z. Jin, G. Sulligoi, R. M. Cuzner, L. Meng, J. C. Vasquez and J. M. Guerrero, "Next-Generation Shipboard DC Power System: Introduction Smart Grid and dc Microgrid Technologies into Maritime Electrical Networks," in *IEEE Electrification Magazine*, vol. 4, no. 2, pp. 45-57, June 2016
25. Ginn, H.; Cuzner, R. M., "The Shipboard Integrated Power System," in *IEEE Electrification Magazine*, vol. 3, no. 2, pp. 2-3, June 2015
26. Cuzner, R.; Venkataramanan, G., "Current source rectifiers in discontinuous conduction modes of operation", *Industry Applications, IEEE Transactions on*, vol.51, no.1, pp.470-478, Jan.-Feb. 2015
27. Cuzner, R.; Drews, D.; Venkataramanan, G., "Power Density and Efficiency Comparisons of System-Compatible Drive Topologies," *Industry Applications, IEEE Transactions on*, vol.51, no.1, pp.459-469, Jan.-Feb. 2015
28. Schmerda, R.; Cuzner, R.; Clark, R.; Nowak D.; Bunzel, S., "Shipboard Solid-State Protection: Overview and Applications," in *IEEE Electrification Magazine*, vol. 1, no. 1, pp. 32-39, Sept. 2013
29. Cuzner, R.; Drews, D.; Kranz, W.; Bendre, A.; Venkataramanan, G., "Power-Dense Shipboard-Compatible Low-Horsepower Variable-Frequency Drives," *Industry Applications, IEEE Transactions on*, vol.48, no.6, pp.2121,2128, Nov.-Dec. 2012
30. Cuzner, R.M.; Bendre, A.R.; Faill, P.J.; Semenov, B., "Implementation of a Four-Pole Dead-Time-Compensated Neutral-Point-Clamped Three-Phase Inverter With Low Common-Mode Voltage Output," *Industry Applications, IEEE Transactions on*, vol.45, no.2, pp.816-826, March-April 2009
31. Bendre, A.; Cuzner, R.; Krstic, S., "Three-level converter system," *Industry Applications Magazine, IEEE*, vol.15, no.2, pp.12,23, March-April 2009
32. Cuzner, R.M.; Nowak, D.J.; Bendre, A.; Oriti, G.; Julian, A.L., "Mitigating Circulating Common-Mode Currents Between Parallel Soft-Switched Drive Systems," *Industry Applications, IEEE Transactions on*, vol.43, no.5, pp.1284-1294, Sept.-oct. 2007
33. Bendre, A.; Wallace, I.; Luckjiff, G.A.; Norris, S.; Gascoigne, R.W.; Divan, D.; Cuzner, R.M., "Design considerations for a soft-switched modular 2.4-MVA medium-voltage drive," *Industry Applications, IEEE Transactions on*, vol.38, no.5, pp.1400-1411, Sep/Oct 2002
34. Cuzner, R.M.; Abel, J.; Luckjiff, G.A.; Wallace, I., "Evaluation of actively clamped resonant link inverter for low-output harmonic distortion high-power-density power converters," *Industry Applications, IEEE Transactions on*, vol.37, no.3, pp.847-855, May/June 2001

#### **Conference Papers:**

35. X. Li, Y. Chen, Y. Wu, H. Chen, W. Weber, A. Nasiri, R. Cuzner, Y. Zhao, and A. Mantooth. "High Voltage SiC Power Module Optimized for Low Parasitics and Compatible System Interface." In *2022 IEEE Applied Power Electronics Conference and Exposition (APEC)*, 2022 Mar 20 (pp. 999-1003). IEEE.
36. R. Siddaiah, M. Vygoder, R. M. Cuzner, J. C. Ordonez, and M. B. Chagas. "Virtual Prototyping Process For Assessment of Medium Voltage Grid-Connected Solid State Transformer Implementations." In *2021 IEEE Energy Conversion Congress and Exposition (ECCE)*, pp. 1156-1163
37. M. Vygoder, F. Banihashemi, J. Gudex, R. M. Cuzner and G. Oriti, "Coordination of Protection and Ride-through Settings for Islanded Facility Microgrids," *2021 IEEE Energy Conversion Congress and Exposition (ECCE)*, 2021, pp. 1095-1102.

38. S. Beheshtaein, R. Cuzner "A New Y-IGCT-based DC Circuit Breaker for NASA N3-X Spacecraft", In *2021 IEEE Applied Power Electronics Conference and Exposition (APEC)*, 2021 Jun 14 (pp. 1215-1218). IEEE.
39. Beheshtaein, S., Alshafei, A., Jean-Pierre, G., Altin, N., Khayamy, M., Cuzner, R. and Nasiri, A, "An Optimal Design of a Hybrid Liquid/Air Cooling System for High Power, Medium Frequency, and Medium Voltage Solid-State Transformer." In *2021 IEEE 12th International Symposium on Power Electronics for Distributed Generation Systems (PEDG)*, pp. 1-8. IEEE, 2021.
40. F. Banihashemi, S. Beheshtaein, R. Cuzner, "Novel Hybrid Circuit Breaker Topology Using a Twin Contact Mechanical Switch", in *2021 9th International Conference on Smart Grid (icSmartGrid)*, 2021 Jun 29 (pp. 132-136). IEEE.
41. J. Gudex, R. Cuzner, "Multiple Line-to-Ground Fault Characterization and Mitigation in MVDC Shipboard Electrical Systems", in *2021 IEEE Electric Ship Technologies Symposium (ESTS)*, 2021 Aug 3 (pp. 1-9). IEEE.
42. R. M. Cuzner, W. J. Koebel, "Application of IEC-61800-5 Insulation Coordination to Shipboard Equipment Scaling Studies", in *2021 IEEE Electric Ship Technologies Symposium (ESTS)*, 2021 Aug 3 (pp. 1-11). IEEE.
43. S. Beheshtaein, M. Saravani, F. Banihashemi, R. Cuzner, "Optimal Design of a Novel High-Power Thyristor-based DC Circuit Breaker" in *2020 IEEE Energy Conversion Congress and Exposition (ECCE)*, 2020 Oct 11 (pp. 6030-6035). IEEE.
44. M. Milton, A. Benigni, M. Vygoder, J. Gudex, R. Cuzner, "Power electronic system real-time simulation on national instruments FPGA platforms", in *2019 IEEE Electric Ship Technologies Symposium (ESTS)* 2019 Aug 14 (pp. 32-38). IEEE.
45. Banihashemi F, Vygoder M, Hoeft N, Cuzner R. "Earthing Arrangements Impacts on Protection Schemes for a Commercial Microgrid", in *2019 8th International Conference on Renewable Energy Research and Applications (ICRERA)*, 2019 Nov 3 (pp. 413-421). IEEE.
46. R. Hosseini and R. Cuzner, "A High Frequency Power Transformer for isolated bidirectional DC-DC Converter used for MVDC Collection System in Wind Farms," *2019 8th International Conference on Renewable Energy Research and Applications (ICRERA)*, Brasov, Romania, 2019, pp. 593-598
47. S. Beheshtaein, S. Golestan, R. Cuzner and J. M. Guerrero, "A New Adaptive Virtual Impedance based Fault Current Limiter for Converters," *2019 IEEE Energy Conversion Congress and Exposition (ECCE)*, Baltimore, MD, USA, 2019, pp. 2439-2444
48. N. Hoeft, M. Vygoder and R. Cuzner, "Fault Characterization of Radial AC Microgrid Containing Multiple Distributed Energy Resources at Medium and Low Voltage Levels," *2019 8th International Conference on Renewable Energy Research and Applications (ICRERA)*, Brasov, Romania, 2019, pp. 259-264
49. T. Damle, C. Park, J. Ding, P. Cheetham, M. Bosworth, M. Steurer, R. Cuzner, L. Graber, "Experimental setup to evaluate creepage distance requirements for shipboard power systems," *2019 IEEE Electric Ship Technologies Symposium (ESTS)*, Washington, DC, USA, 2019, pp. 317-323
50. M. Ramezani, F. Musavi, S. Golestan, S. Beheshtaein, J. M. Guerrero and R. Cuzner, "A GaN-Based Active Power Decoupling Approach for Enhancing the Efficiency and Reliability of Residential PV Microinverters," *2019 IEEE Energy Conversion Congress and Exposition (ECCE)*, Baltimore, MD, USA, 2019, pp. 2039-2046
51. R. Cuzner and R. Siddaiah, "Derivation of Power System Module Metamodels for Early Shipboard Design Explorations," *2019 IEEE Electric Ship Technologies Symposium (ESTS)*, Washington, DC, USA, 2019, pp. 90-96
52. R. Cuzner, R. Siddaiah and T. Nguyen, "Applying a Virtual Prototyping Process to Generate Pareto Optimal Solutions for a Modular Multi-Level MVAC to MVDC Converter," *2019 IEEE 28th International Symposium on Industrial Electronics (ISIE)*, Vancouver, BC, Canada, 2019, pp. 2039-2046
53. M. Milton, A. Benigni, M. Vygoder, J. Gudex and R. Cuzner, "Power Electronic System Real-Time Simulation on National Instruments FPGA Platforms," *2019 IEEE Electric Ship Technologies Symposium (ESTS)*, Washington, DC, USA, 2019, pp. 32-38

54. F. Banihashemi, M. Vygoder, N. Hoeft and R. Cuzner, "Earthing Arrangements Impacts on Protection Schemes for a Commercial Microgrid," *2019 8th International Conference on Renewable Energy Research and Applications (ICRERA)*, Brasov, Romania, 2019, pp. 413-421
55. M. Vygoder, J. Gudex, R. Cuzner, M. Milton and A. Benigni, "Real Time Simulation of Transient Overvoltage and Common-Mode during Line-to-Ground Fault in DC Ungrounded Systems," *IECON 2019 - 45th Annual Conference of the IEEE Industrial Electronics Society*, Lisbon, Portugal, 2019, pp. 6451-6456
56. A. D. Brovont and R. M. Cuzner, "DM and CM Modeling Of Non-Isolated Buck Converters for EMI Filter Design," *2018 IEEE Transportation Electrification Conference and Expo (ITEC)*, Long Beach, CA, 2018, pp. 140-145
57. A. Brovont and R. Cuzner, "Modeling Common-Mode Circulating Currents in Paralleled Non-Isolated DC-DC Converter-Based Systems," *2018 IEEE Energy Conversion Congress and Exposition (ECCE)*, Portland, OR, 2018, pp. 4187-4194
58. M. Karami, R. Tallam and R. Cuzner, "Comparison of Three-Level and Two-Level Converters for AFE Application," *2018 IEEE 6th Workshop on Wide Bandgap Power Devices and Applications (WIPDA)*, Atlanta, GA, 2018, pp. 264-270
59. R. Cuzner, M. Vygoder and R. Siddaiah, "Power Conversion and Distribution Equipment Metamodels for Dependable Design of Shipboard Integrated Power and Energy Systems," *2018 IEEE International Conference on Electrical Systems for Aircraft, Railway, Ship Propulsion and Road Vehicles & International Transportation Electrification Conference (ESARS-ITEC)*, Nottingham, 2018, pp. 1-8
60. M. Karami and R. M. Cuzner, "Optimal Control of Modular MultiLevel Converters (MMCs) for Minimum Storage Requirement," *IECON 2018 - 44th Annual Conference of the IEEE Industrial Electronics Society*, Washington, DC, 2018, pp. 3965-3972
61. S. Beheshtaein, R. Cuzner, A. Benigni, M. Savaghebi and J. M. Guerrero, "A New Communication-less Harmonic-based Protection Architecture for Meshed Microgrids," *2018 IEEE Energy Conversion Congress and Exposition (ECCE)*, Portland, OR, 2018, pp. 502-508
62. S. Beheshtaein, M. Savaghebi, J. M. Guerrero, R. Cuzner and J. C. Vasquez, "A secondary-control based fault current limiter for four-wire three phase inverter-interfaced DGs," *IECON 2017 - 43rd Annual Conference of the IEEE Industrial Electronics Society*, Beijing, 2017, pp. 2363-2368
63. K. Palaniappan, W. Sedano, N. Hoeft, R.M. Cuzner, J. Z. Shen, "Fault Discrimination Using SiC JFET Based Self-Powered Solids State Circuit Breakers in a Residential DC Community Microgrid", in *Energy Conversion Congress and Exposition (ECCE), 2017 IEEE*, Cincinnati, OH
64. S. Beheshtaein, J. Yu and R. M. Cuzner, "A novel wavelet-based feature extraction from common mode currents for fault location in a residential DC microgrid," *2017 IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA, 2017, pp. 706-711
65. K. Palaniappan and R. M. Cuzner, "Educating students as a means to help people in a low income community live in a DC microgrid laboratory," *2017 IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA, 2017, pp. 339-344
66. R. M. Cuzner, K. Palaniappan, W. Sedano, N. Hoeft and M. Qi, "Fault characterization and protective system design for a residential DC microgrid," *2017 IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA, 2017, pp. 642-647
67. R. Cuzner, S. Cruz, F. Ferrese and R. Hosseini, "Power converter metamodeling approach for the smart ship design environment," *2017 IEEE Electric Ship Technologies Symposium (ESTS)*, Arlington, VA, 2017, pp. 118-125
68. M. Karami, R. Cuzner, " Optimal sizing of modular multi-level converters designed for shipboard applications," *2017 IEEE Electric Ship Technologies Symposium (ESTS)*, Arlington, VA, 2017, pp. 118-125
69. K. Palaniappan, S. Veerapeneni, R. Cuzner and Y. Zhao, "Assessment of the feasibility of interconnected smart DC homes in a DC microgrid to reduce utility costs of low income households," *2017 IEEE Second International Conference on DC Microgrids (ICDCM)*, Nuremburg, 2017, pp. 467-473

70. A. Vicenzutti, G. Sulligoi, R. Cuzner and V. Singh, "Simplified analytical modeling and experimental validation of diode bridge rectifier operation during rail-to-rail short-circuit faults in synchronous generator-fed DC distribution systems," *2017 IEEE Second International Conference on DC Microgrids (ICDCM)*, Nuremburg, 2017, pp. 596-601
71. R. M. Cuzner, M. Qi, K. Palaniappan, W. Sedano, "SiC JFET Based Protection System in a Residential DC Microgrid", in *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA
72. R. M. Cuzner, S. Baheshtaein, J. Yu, "Wavelet-Based Extraction of Information from Common Mode Currents Measurements in a Residential DC Microgrid", in *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA
73. K. Palaniappan, R. M. Cuzner, "Educating Students as a Means to Help People in a Low Income Community Live in a DC Microgrid Laboratory", in *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA
74. Jiao, Q.; Hosseini, R.; Cuzner, R. M., "A Comparison between Silicon Carbide Based Current Source Rectifier and Voltage Source Rectifier for Applications in Community DC Microgrid", *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, Birmingham, U.K., 2016
75. Yang, R.; Cuzner, R. M., "Single Ground Fault Location Algorithm in DC Microgrid Based on Wavelet Transform", *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, Birmingham, U.K., 2016
76. Karami, M.; Cuzner, R. M., "A Distributed Controller for DC Microgrids Stability Enhancement", *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, Birmingham, U.K., 2016
77. Rashidi, M.; Nasiri, N.; Cuzner R. M., "Application of Multi-Port Solid State Transformers for Microgrid Based Distribution System", *2016 International Conference on Renewable Energy Research and Applications (ICRERA)*, Birmingham, U.K., 2016
78. Cuzner, R. M.; Lemmon, A.; Gafford, J.; Hosseini, R.; Mazzola, M., "Control and Characterization of Electromagnetic Emissions in Wide Band Gap Based Converter Modules for Ungrounded Grid-Forming Applications," *Applied Power Electronics Conference (APEC) 2016*, to be presented on March 21, 2016
79. R. M. Cuzner, K. Palaniappan and Z. J. Shen, "System specification for a DC community microgrid and living laboratory embedded in an urban environment," *2015 International Conference on Renewable Energy Research and Applications (ICRERA)*, Palermo, Italy, 2015, pp. 1119-1125
80. Wei Fu, Qianqian Jiao, R. Hosseini, R. Cuzner and A. Lemmon, "Methodology for the volume minimization in non-isolated SiC based PV inverters," *2015 International Conference on Renewable Energy Research and Applications (ICRERA)*, Palermo, Italy, 2015, pp. 1236-1242
81. Cuzner, R.M.; Singh, V.; Rashidi, M.; Nasiri, A., "Converter topological and solid state protective device trade-offs for future shipboard MVDC systems," in *Electric Ship Technologies Symposium (ESTS), 2015 IEEE*, pp.34-39, 21-24 June 2015
82. Rose, M.W.; Cuzner, R.M., "Fault isolation and reconfiguration in a three-zone system," in *Electric Ship Technologies Symposium (ESTS), 2015 IEEE*, pp.409-414, 21-24 June 2015
83. Cuzner, R.; Esmaili, A., "Fault tolerant shipboard MVDC architectures", *International Conference on Electrical Systems for Aircraft, Railway, Ship Propulsion and Road Vehicles, 2015 IEEE (ESARS)*, March 3-5, 2015
84. Cuzner, R. M., "Power electronics packaging challenges for future warship applications," *Integrated Power Packaging (IWIPP), 2015 IEEE International Workshop on*, Chicago, IL, 2015, pp. 5-8.
85. Cuzner, R.; Drews, D.; Venkataramanan, G., "Power density and efficiency of system compatible, sine-wave input/output drives," *Energy Conversion Congress and Exposition (ECCE), 2012 IEEE*, pp.4561-4568, 15-20 Sept. 2012
86. Cuzner, R., Drews, D., Kennet, K., Lu, R., Corey, C., Fahlstedt, W., "Power Dense Variable Speed Drive/PM Motor Systems for Shipboard Fan Coil Assemblies", *ASNE Conference Proceedings*, 2012

87. Kranz, W.R.; Cuzner, R.M.; Drews, D.J.; Bendre, A.R.; Venkataramenan, G., "Implementation of sine-wave input/output BLDC inverter for low inductance shipboard PM motor drives using modular power platform," *Electric Ship Technologies Symposium (ESTS), 2011 IEEE*, pp.46-51, 10-13 April 2011
88. Cuzner, R.M.; Sielicki, T.; Archibald, A.E.; McFarlin, D.A., "Management of ground faults in an ungrounded multi-terminal zonal DC distribution system with auctioneered loads," *Electric Ship Technologies Symposium (ESTS), 2011 IEEE*, pp.300-305, 10-13 April 2011
89. Cuzner, R.M.; Bendre, A.R.; Widmann, J.D.; Stonger, K.A.; Peshman, S.M.; Carlton, J.S.; Fischer, J.A., "Considerations when diode auctioneering multiple DC buses in a non-isolated DC distribution system," *Electric Ship Technologies Symposium (ESTS), 2011 IEEE*, pp.277-282, 10-13 April 2011
90. Cuzner, R.; MacFarlin, D.; Clinger, D.; Rumney, M.; Castles, G., "Circuit breaker protection considerations in power converter-fed DC Systems," *Electric Ship Technologies Symposium, 2009. ESTS 2009. IEEE*, pp.360-367, 20-22 April 2009
91. Cuzner, R.; Jeutter, A., "DC zonal electrical system fault isolation and reconfiguration," *Electric Ship Technologies Symposium, 2009. ESTS 2009. IEEE*, pp.227-234, 20-22 April 2009
92. Julian, A.L.; Cuzner, R.M., "Design, modelling and stability analysis of an integrated shipboard DC power system," *Electric Ship Technologies Symposium, 2009. ESTS 2009. IEEE*, pp.428-432, 20-22 April 2009
93. Cuzner, R.M.; Venkataramanan, G., "The Status of DC Micro-Grid Protection," *Industry Applications Society Annual Meeting, 2008. IAS '08. IEEE*, pp.1-8, 5-9 Oct. 2008
94. Cuzner, R.M.; Bendre, A.R.; Faill, P.J.; Semenov, B., "Implementation of a Non-Isolated Three Level DC/DC Converter Suitable for High Power Systems," *Industry Applications Conference, 2007. 42nd IAS Annual Meeting. Conference Record of the 2007 IEEE*, pp.2001-2008, 23-27 Sept. 2007
95. Oriti, G.; Cuzner, R.M., "Ship Propulsion AC/DC Conversion System Modeling and Design," *Industry Applications Conference, 2006. 41st IAS Annual Meeting. Conference Record of the 2006 IEEE*, pp.569-575, 8-12 Oct. 2006
96. Cuzner, R.; Goshaw, C.; Nguyen, T.; Bendre, A.; Mekhiche, M., "Evaluation of medium voltage electric propulsion drive for electromagnetic compatibility using multidomain modeling," *Industry Applications Conference, 2004. 39th IAS Annual Meeting. Conference Record of the 2004 IEEE*, pp.2010-2017 vol.3, 3-7 Oct. 2004
97. Cuzner, R.M.; VanderMeer, J. C.; "Impacts to the power density of ship electric drives." *Power electronics society newsletter*, Vol.16, No.3, 2004
98. Cuzner, R.M.; Nowak, D.J.; Bendre, A.; Oriti, G.; Julian, A.L., "Control and implementation issues with paralleling soft-switched drive systems," *Industry Applications Conference, 2003. 38th IAS Annual Meeting. Conference Record of the*, pp.2018-2025 vol.3, 12-16 Oct. 2003
99. Weber, W. J., Cuzner, R. M., Ruckstadter, E., Smith, J., "Engineering fundamentals of multi-MW variable frequency drives—how they work, basic types, and application considerations", *31st Turbomachinery Symposium*, pp. 177-194, September 2002
100. Julian, A.L.; Cuzner, R.; Oriti, G.; Lipo, T.A., "Active filtering for common mode conducted EMI reduction in voltage source inverters," *Applied Power Electronics Conference and Exposition, 1998. APEC '98. Conference Proceedings 1998, Thirteenth Annual*, pp.934-939 vol.2, 15-19 Feb 1998
101. Rao, S.C.; Cuzner, R.M., "Capacitor excited single phase brushless generator design and modelling using dq variables," *Power Electronics, Drives and Energy Systems for Industrial Growth, 1996., Proceedings of the 1996 International Conference on*, pp.523-529 vol.1, 8-11 Jan 1996
102. Cuzner, R.M.; Rao, S.C., "Validation study of mathematical model for brushless, capacitor-excited single phase synchronous generator," *Industry Applications Conference, 1996. Thirty-First IAS Annual Meeting, IAS '96., Conference Record of the 1996 IEEE*, pp.843-849 vol.2, 6-10 Oct 1996

103. Cuzner, R.M.; Lorenz, R.D.; Novotny, D.W., "Application of nonlinear observers for rotor position detection on an induction motor using machine voltages and currents," *Industry Applications Society Annual Meeting, 1990., Conference Record of the 1990 IEEE*, vol., no., pp.416,421 vol.1, 7-12 Oct. 1990

### **Patents:**

1. "Four Pole NPC 3-Phase Converter with Zero Common Mode Voltage Output", US 2008/0298103
2. "Harmonic Regulator for Current Source Rectification and Inversion", US 20130314953A1
3. "Current Source Rectifier Modulation in Discontinuous Modes of Operation", US 8873261
4. "Multilevel Power Converter Architecture", P170314US01

### **Teaching:**

#### ***University***

**Assistant Professor, University of Wisconsin-Milwaukee, 2014 to present**

EE 362, Electromechanical Energy Conversion (Rating: 4.28/5.0)

Supervising of two TAs and one grader.

EE 572, Power Electronics (Rating: 4.63/5.0)

EE 575, Analysis of Motor Drives (Rating: 4.8/5.0)

EE890, Electromagnetic Interference of Power Electronic Systems

#### ***Tutorials***

**Energy Conversion Congress and Exposition (ECCE), 2016, Milwaukee, WI**

Co-Instructor, Shipboard DC Microgrids

#### ***Workshop Presenter***

**Office of Naval Research Controls Workshop, August 22, 2017, Philadelphia, PA**

Sizing of Cabinets for Shipboard Applications

**Integration of Software Tools for Power Electronics Design (ISTPED) July 2000; Roanoke, Virginia**

Simulating Power Electronic Systems and simulation environments

#### ***Symposium Instructor***

**31<sup>st</sup> Turbomachinery Symposium, September 9-12, 2002, Houston Texas**

Taught a half-day beginner's course on VSDs to petro-chemical industry participants

#### ***Tutorial Organizer***

**IEEE Industry Applications Annual Conference October 11-15, 1998; St. Louis, Missouri**

Organized, compiled and moderated a full day tutorial on the design and manufacture of single phase motors involving four recognized experts in the area

#### ***On-Site Training***

**Nuclear Prototype Testing Unit, Knolls Atomic Power Lab November, 1995; Balston Spa, NY**

Provided several days of training to Navy nuclear submariners on the use of a solid state motor-generator set that was developed and installed at their facility.

### **Graduate Education:**

Graduated 2 PhD students

Graduated 8 M.S. students with thesis defense

Currently advising 6 PhD students (one at dissertator status) and 2 M.S. students, and managing one Post-Doc

Currently providing support to 8 research assistants

### **Service:**

Advisor to Solar Ambassador Team

Member of Graduate Program Subcommittee

Advisor to Three Undergraduate Researchers

### **External Service:**

***Co-Editor***

IEEE Electrification Magazine

***Guest Editor***

IEEE Electrification Magazine,  
June 2016 issue on DC Microgrids  
June 2015 issue on Electric Ships

***Chair***

Industrial Drives Committee, IEEE-Industry Applications Society    October 2005 to October 2007

***Associate Editor***

International Journal on Renewable Energy Systems    November 2016 to present  
Transactions on Industry Applications    October 2003 to October 2005

***Conference Organizer***

Industry Applications Society Annual Meeting    October 2001 to October 2003

***Member, Industrial Advisory Board***

NSF-Funded Center for Power Electronics Systems, Virginia Tech    April 1995 to April 2006  
NSF-Funded Freedom Center, North Carolina State    September 2005 to September 2008

**Standards:**

***Working Group Member and Balloting Committee Member***

**IEEE Std 1709-2010**

“IEEE Recommended Practice for 1kV to 35kV Medium-Voltage DC Power Systems on Ships”

***Contributor***

**Mil-PRF-32168**

“Performance Specification, Variable Speed Drive System for Induction and Synchronous Machines”

***Contributor***

**Mil-Std-1399 Sec 300C (in process)**

“Department of Defense Standard on Electric Power, Alternating Current” Specific Skills: