

Amarendra Edpuganti, PhD

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SUMMARY

Power electronics researcher with expertise in converter topologies and modulation techniques. Author/co-author of 36 peer reviewed publications and inventor for 4 international patents. Total work experience of nine plus years which includes seven years of post-doctoral research.

RESEARCH INTERESTS

➤ **Power electronics applications**

- Electrical vehicles
- Fuel cell applications
- Renewable energy integration

EDUCATION

Ph.D. : National University of Singapore, Singapore; Electrical and Computer Eng.; February 2016.

M.Tech. : Indian Institute of Technology, Kanpur, India; Electrical Eng.; July 2012.

B.Tech. : National Institute of Technology, Warangal, India; Electrical Eng.; July 2007.

RESEARCH EXPERIENCE

Advanced Power and Energy Center (APEC), Khalifa University, Abu Dhabi, United Arab Emirates

Research Scientist, July 2022 – December 2022 (6 months)

Post-doctoral fellow, Nov 2020 – June 2022 (1 year 8 months)

The main goal of the project is to innovate and develop new converter topologies for CubeSat electric power system, DC microgrid, and electrical vehicle charging. As a part of this project, I have been guiding one master and one PhD student in their thesis work. The master student's work is focused on four-port converter for dc microgrid application, whereas the PhD student work is related to multiport topologies and system architectures for simultaneous AC and DC charging of electrical vehicles to achieve faster charging.

Key Contributions:

- Experimental validation of multiple-input multiple-output converter for CubeSat EPS.
- Proposed new architecture to achieve compact and efficient EPS for CubeSats.
- Experimental validation of new single-phase on-board fast charger for light electric vehicles.
- Development and experimental validation of four-port converter for DC microgrids.
- Experimental demonstration of simultaneous AC and DC charging of electrical vehicles.

MI-MIT Collaboration Research, Khalifa University, Abu Dhabi, United Arab Emirates

Post-doctoral fellow, July 2018 – Oct 2020 (2 year 3 months)

The main objective of my research is to find and develop new compact converter topologies, architectures and control strategies for the CubeSat's electric power system (EPS). I have developed new converter topologies which reduce the converter footprint by using minimal number of inductors, which helps in placing redundant components to improve the overall reliability of EPS. One of the main challenges for the experimental verification of these converter topologies is developing printed circuit boards (PCBs) with smallest possible footprint. These topologies are submitted as invention disclosures for patenting and we have plans to launch start-up company for developing CubeSat's EPS. In addition, I guided a master's student in the thesis which is related to utilization of supercapacitors in CubeSat's to extend the mission duration.

Key Contributions:

- Proposed multiport converter with single inductor for CubeSat EPS.
- Proposed multiple-input multiple-output converter for CubeSat EPS.

- Proposed new distributed architecture with enhanced fault-tolerant capability for CubeSat EPS.
- Detailed study of ultra-capacitor utilization in CubeSats.
- Development of power-down strategy to improve the reliability of CubeSat EPS.

**ABB India Development Centre, Chennai, India,
Scientist, October 2015 – July 2018 (2 year 9 months)**

Worked with the Grid Integration R &D team, India in close collaboration with HVDC R&D team in ABB Ludvika, Sweden for developing next generation HVDC converter topology.

Key Contributions:

- Control development for steady-state operation.
- Control strategies for thyristor commutation process.
- Converter operation and control during internal faults.
- Transient current and transient voltages studies.
- Topology evaluation for HVDC systems.

National University of Singapore, Singapore.

Research Scholar, August 2012 – September 2015

Ph.D. Thesis on “**Optimal Pulse Width Modulation of Multilevel Inverters for Medium Voltage Drives**”

Key contributions:

- Proposed new generalized synchronous optimal pulse width modulation (SOP) technique to achieve low switching modulation of multilevel inverters for medium-voltage (MV) induction motor drives.
- Developed modified SOP technique for modular multilevel converter fed MV drives.
- Proposed enhanced SOP technique for dual multilevel inverter fed open-end stator winding induction motor drives to eliminate common-mode currents in the stator windings.
- Proposed new modular converter topology for open-end stator winding induction motor drives.

Indian Institute of Technology, Kanpur, India.

Masters Research, August 2011 – July 2012

M.Tech. Thesis on “**Low Voltage Ride through Solutions for DFIG Wind Turbine**”

Key contributions:

- Analysis of DFIG under grid fault conditions
- Series compensation methods to achieve low voltage ride through capability.

WORK EXPERIENCE

Adobe Systems India Private Limited, Bangalore, India,

Software Engineer, August 2007 – December 2009 (2 year 4 months)

Key contributions:

- Development of automation framework for testing of Flash Media Server.
- Developed test scripts for functional validation of Flash Media Server.

TECHNICAL SKILLS

- *Programming Languages:* C, C++.
- *Tools & Software:* PSCAD, HiDraw, MATLAB/SIMULINK, PSIM, PLECS, FPGA, DSP, Microcontroller, Altium Designer, Code composer studio (CCS).
- System analysis and mathematical modeling, PCB design, Experimental validation of concepts.

TEACHING ASSISTANCESHIP

- Preparing lab experiments setup, tutoring, assisting students in conducting lab experiments of undergraduate courses such as **power electronics, introduction to circuits and systems, electric drives, and solar photovoltaic energy systems.**

- Developed a new lab experiment “Maximum power point tracking for a solar panel charging a super capacitor” for solar photovoltaic energy systems course for undergraduate students.

HONORS AND AWARDS

- **All India Rank-26 (99.95 percentile)** in Graduate Aptitude Test in Engineering (GATE)-2010.
- Awarded **3rd prize in IEEE IAS CMD Student Thesis Contest 2016** in the PhD category.
- Awarded **1st prize paper award in 2020 IAS Annual Meeting** conference.
- Awarded **NUS Research Scholarship** for Ph.D. by National University of Singapore for 2012-2016.
- **Scholarship for Master’s Degree** at Indian Institute of Technology Kanpur by Ministry of Human Resource and Development (MHRD) and University Grants Commission (UGC) for 2010-2012.
- Achieved **All India Rank-1749 (99.46 percentile)** in All India Engineering Entrance Examination (AIEEE)-2003.

PATENTS

1. **Amarendra E**, Khirod Kumar Nayak, Gaurav Kumar Kasal and Sasitharan S, “Series Modular DC to DC converter”, **WO 2019/238239 A1**.
2. Malaya Sahu, Hongbo Jiang, V Vekhande, M Holm, Sasitharan S, Praveen B, and **Amarendra E**, “Voltage source converters and method of energization thereof”. **WO 2020/049375 A1**.
3. Vinod Khadkikar, Radha Kushwaha, Hatem Zeineldin, Hadi Otrok, and Rabeb Mizouni, Shakti Singh, Umesh S. Baktharahalli, Abass Afolabi Yahaya, and **Amarendra E**, “EV Chargers and EV Charging”, **PCT/IB2021/060888** (filed on November 23, 2021).
4. **A. Edpuganti**, V. Khadkikar, H. Zieneldin, and M. S. Elmoursi, “Multiport converters, Multiple-input Multiple-output converters, and Power-down Modes for Satellite electric power system”, **PCT/IB2022/052183**. (Filed on March 11, 2022)

PUBLICATIONS

BOOK CHAPTERS

1. R. Kushwaha, A. Edpuganti, and V. Khadkikar, “Power quality aspects of smart grid in presence of electric vehicle charging”, in book “Design and Control of Active Power Filters towards the Decarbonisation of Smart Grid Networks”, Elsevier 2022.

JOURNALS

1. A.A. Saafan, V. Khadkikar, **A. Edpuganti**, M. S. Elmoursi, and H. Zieneldin, “A Novel Non-isolated Four-Port Converter for Flexible DC Microgrid Operation”, Accepted, **IEEE Transactions on Industrial Electronics**.
2. **A. Edpuganti**, V. Khadkikar, N. A. Sayari and B. Zahawi, "Single-Inductor Multiple-Input Multiple-Output Converter for CubeSats Electric Power System," in **IEEE Transactions on Power Electronics**, doi: 10.1109/TPEL.2023.3243928.
3. A. Edpuganti, V. Khadkikar, H. Zeineldin, M. S. E. Moursi and M. A. Hosani, "Enhancing Lifetime of 1U/2U CubeSat Electric Power System With Distributed Architecture and Power-Down Mode," in **IEEE Transactions on Industry Applications**, vol. 58, no. 1, pp. 901-913, Jan.-Feb. 2022, doi: 10.1109/TIA.2021.3128373. **Impact factor: 3.654**.
4. **A. Edpuganti**, V. Khadkikar, M. S. Elmoursi, H. Zeineldin, N. Alsayari, and K. Al Hosani, "A Comprehensive Review on CubeSat Electrical Power System Architectures," in **IEEE Transactions on Power Electronics**, vol. 37, no. 3, pp. 3161-3177, March 2022, doi: 10.1109/TPEL.2021.3110002. **Impact factor: 6.153**.
5. **A. Edpuganti**, V. Khadkikar, M. S. El Moursi and H. Zeineldin, "A Novel Multiport Converter Interface for Solar Panels of CubeSat," in **IEEE Transactions on Power Electronics**, vol. 37, no. 1, pp. 629-643, Jan. 2022. **Impact factor: 6.153**.

6. **A. Edpuganti**, V. Khadkikar, H. Zeineldin, M. S. El Moursi and M. Al Hosani, "Comparison of Peak Power Tracking Based Electric Power System Architectures for CubeSats," in *IEEE Transactions on Industry Applications*, vol. 57, no. 3, pp. 2758-2768, May-June 2021. **Impact factor: 3.654.**
7. K.Gnanasambandam; **A. Edpuganti**; A.K. Rathore; D.Srinivasan; and J.Rodriguez, "Hybrid SVM-SOPWM Modulation of Current-Fed Three-level Inverter for High Power Application", *IEEE Transactions on Industry Applications*, vol. 55, no. 4, pp. 4344-4358, July-Aug. 2019. **Impact factor: 3.654.**
8. C. Buccella; C. Cecati; M. G. Cimatorini; G. Kulothungan; **A. Edpuganti**; A. K. Rathore, "A Selective Harmonic Elimination Method for 5-Level Converters for Distributed Generation," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 5, no. 2, pp. 775-783, June 2017. **Impact factor: 4.472.**
9. K. Gnanasambandam; **A. Edpuganti**; A. Rathore; and D. Srinivasan, "Modified Synchronous Pulse Width Modulation of Current-Fed Five-Level Inverter for Solar Integration," *IEEE Transactions on Power Electronics*, vol. 32, no. 5, pp. 3370-3381, May 2017. **Impact factor: 6.153.**
10. K.Gnanasambandam; A.K. Rathore; **A. Edpuganti**; D.Srinivasan; and J.Rodriguez, "Current-fed Multilevel Converters: An Overview of Circuit Topologies, Modulation Techniques, and Applications," *IEEE Transactions on Power Electronics*, vol. 32, no. 5, pp. 3382-3401, May 2017. **Impact factor: 6.153.**
11. **A. Edpuganti** and A. K. Rathore, "Optimal Pulsewidth Modulation for Common-Mode Voltage Elimination Scheme of Medium-Voltage Modular Multilevel Converter-Fed Open-End Stator Winding Induction Motor Drives," *IEEE Transactions on Industrial Electronics*, vol. 64, no. 1, pp. 848-856, Jan. 2017. **Impact factor: 8.236.**
12. K. Gnanasambandam, **A. Edpuganti**, A. K. Rathore, D. Srinivasan, C. Cecati and C. Buccella, "Optimal Low Switching Frequency Pulsewidth Modulation of Current-Fed Three-Level Converter for Solar Power Integration," *IEEE Transactions on Industrial Electronics*, vol. 63, no. 11, pp. 6877-6886, Nov. 2016. **Impact factor: 8.236.**
13. **A. Edpuganti** and A. K. Rathore, "Optimal Pulsewidth Modulation of Medium-Voltage Modular Multilevel Converter," *IEEE Transactions on Industry Applications*, vol. 52, no. 4, pp. 3435-3442, July-Aug. 2016. **Impact factor: 3.654.**
14. **A. Edpuganti** and A. K. Rathore, "A Survey of Low Switching Frequency Modulation Techniques for Medium-Voltage Multilevel Converters," *IEEE Transactions on Industry Applications*, vol.51, no.5, pp. 4212-4228, Sept.-Oct. 2015. **Impact factor: 3.654.**
15. **A. Edpuganti** and A. K. Rathore, "New Optimal Pulsewidth Modulation for Single DC Link Dual Inverter-fed Open-end Stator Winding Induction Motor Drive," *IEEE Transactions on Power Electronics*, vol.30, no.8, pp. 4386-4393, Aug. 2015. **Impact factor: 6.153.**
16. **A. Edpuganti** and A. K. Rathore, "Fundamental Switching Frequency Optimal Pulse Width Modulation of Medium Voltage Cascaded Seven-Level Inverter," *IEEE Transactions on Industry Applications*, vol.51, no.4, pp. 3485-3492, July-Aug. 2015. **Impact factor: 3.654.**
17. **A. Edpuganti** and A. K. Rathore, "Fundamental Switching Frequency Optimal Pulsewidth Modulation of Medium Voltage Nine-Level (9L) Inverter," *IEEE Transactions on Industrial Electronics*, vol.62, no.7, pp. 4096-4104, July. 2015. **Impact factor: 8.236.**
18. **A. Edpuganti** and A. K. Rathore, "Optimal Low Switching Frequency Pulsewidth Modulation of Nine-Level (9L) Cascade Inverter," *IEEE Transactions on Power Electronics*, vol.30, pp. 482-495, Jan. 2015. **Impact factor: 6.153.**
19. **A. Edpuganti** and A. K. Rathore, "Optimal Low Switching Frequency Pulse Width Modulation of Medium Voltage Seven-Level (7L) Cascade-5/3H Inverter," *IEEE Transactions on Power Electronics*, vol.30, no.1, pp. 496-503, Jan. 2015. **Impact factor: 6.153.**

JOURNALS UNDER REVIEW

1. A.A Yahaya, **A. Edpuganti**, V. Khadkikar, and H. Zieneldin, "Simultaneous AC and DC Charging of Electric Vehicle", *IEEE Transactions on Energy Conversion*. **Under Review.**

2. R. Kushwaha, **A. Edpuganti**, and V. Khadkikar, "Electric Vehicle On-board Fast Charging through Maximum Converter Switch Utilization: An Alternate Approach", *IEEE Transactions on Power Electronics*. Under Review.

JOURNALS IN PREPARATION

1. **A. Edpuganti**, V. Khadkikar, N. A. Sayari, B. Zahawi, and H. Zeineldin, "Single-Input Multiple-Output Converter for CubeSat Electric Power System," *IEEE Transactions on Industrial Applications*. In preparation.
2. **A. Edpuganti**, V. Khadkikar, N. Alsayari, and B. Zahawi, "New Compact and Efficient Electric Power System Architecture for CubeSats", *IEEE Transactions on Industrial Electronics*. In preparation.

CONFERENCES

1. **A. Edpuganti**, V. Khadkikar and H. Zeineldin, "Single-Input Multiple-Output Converter for CubeSat Electric Power System," *2022 IEEE 2nd International Conference on Sustainable Energy and Future Electric Transportation (SeFeT), 2022*, pp. 1-5.
2. **A. Edpuganti**, V. Khadkikar, M. S. Elmoursi, H. Zeineldin and M. Al Hosani, "A Novel EPS Architecture for 1U/2U Cubesats with Enhanced Fault-Tolerant Capability," *2020 IEEE Industry Applications Society Annual Meeting*, Detroit, MI, USA, Oct 2020, pp. 1-6.
3. **A. Edpuganti**, V. Khadkikar, H. Zieneldin, M. S. Elmoursi, and M. Al Hosani, "New Submodule Selection Algorithm for Low Device Switching Frequency Modulation of Medium-Voltage Modular Multilevel Converter", *IEEE ICIT 2020*, Buenos Aires, Argentina.
4. **A. Edpuganti**, V. Khadkikar, H. Zieneldin, M. S. Elmoursi, and M. Al Hosani, "Comparison Study of Electric Power System Architectures for CubeSat", *IEEE PESGRE 2020*, Cochin, India.
5. K. Gnanasambandam, A. K. Rathore, **A. Edpuganti** and D. Srinivasan, "A Novel Optimal Space Vector Modulation Technique of Current Source Inverter for Solar Power Integration," *IEEE PEDES 2018*, Chennai, India.
6. K. Gnanasambandam, A. K. Rathore, **A. Edpuganti** and D. Srinivasan, "Hybrid SVM-SOPWM Modulation of Current-Fed Three-level Inverter for High Power Application," *IEEE IAS Annual meeting 2017*, Cincinnati, OH, USA.
7. K. Gnanasambandam, A. K. Rathore, **A. Edpuganti** and D. Srinivasan, "Current-fed multilevel converters: An overview of circuit topologies and modulation techniques," *IEEE IAS Annual meeting 2016*, Portland, OR, USA.
8. **A. Edpuganti**, A. K. Rathore and B. M. Joshi, "Optimal low-switching frequency pulsewidth modulation of dual modular multilevel converter for medium-voltage open-end stator winding induction motor drive," *IEEE IECON 2016*, Florence, Italy.
9. K. Gnanasambandam, A. K. Rathore, **A. Edpuganti** and D. Srinivasan, "Optimal low switching frequency pulse width modulation of current-fed three-level inverter for solar integration," *2016 IEEE Applied Power Electronics Conference and Exposition (APEC)*, Long Beach, CA, USA.
10. K. Gnanasambandam, A. K. Rathore, **A. Edpuganti** and D. Srinivasan, "Optimal low switching frequency pulse width modulation of current-fed five-level inverter for solar integration," *2016 IEEE Applied Power Electronics Conference and Exposition (APEC)*, Long Beach, CA, USA.
11. **A. Edpuganti**, A. Dwivedi, A. K. Rathore and R. K. Srivastava, "Optimal pulsewidth modulation of cascade nine-level (9L) inverter for medium voltage high power industrial AC drives," *IEEE IECON 2015*, Yokohama, Japan.
12. **A. Edpuganti** and A. K. Rathore, "Optimal Pulsewidth Modulation of Medium-Voltage Modular Multilevel Converter," *IEEE IAS Annual meeting 2015*, Dallas, USA.
13. **A. Edpuganti**, A. K. Rathore and A.K. Gupta, "Optimal Fundamental Switching Frequency Pulsewidth Modulation of Medium-Voltage Cascade Nine-Level (9L) Inverter," *IEEE PEDES 2014*, Mumbai, India.
14. **A. Edpuganti** and A. K. Rathore, "A Survey of Low Switching Frequency Modulation Techniques for Medium-Voltage Multilevel Converters," *IEEE IAS Annual meeting 2014*, Vancouver, Canada.

15. **A. Edpuganti** and A. K. Rathore, "Fundamental Switching Frequency Optimal Pulse Width Modulation of Medium Voltage Cascaded Seven-Level Inverter," *IEEE IAS Annual meeting 2014*, Vancouver, Canada.
16. **A. Edpuganti**, A. K. Rathore and J. Holtz, "New optimal pulsewidth modulation for dual inverter-fed open-end stator winding induction motor drive," *IEEE ECCE 2014*, Pittsburgh, USA.
17. **A. Edpuganti** and A. K. Rathore, "Optimal low switching frequency pulsewidth modulation of medium voltage seven-level cascade-5/3H inverter," *IEEE IECON 2013*, Vienna, Austria.

PROFESSIONAL SERVICES

Conference Organizing Committee:

- 1) **Track Chair:** IEEE ITEC-INDIA 2017, Pune, India
- 2) **Session Chair:** IEEE SEFET 2022, Hyderabad, India.

Reviewer of Journals and Conferences:

- 1) IEEE Transactions on Industrial Electronics
- 2) IEEE Transactions on Power Electronics
- 3) IEEE Transactions on Industry Applications
- 4) IEEE Transactions on Smart Grids
- 5) IEEE Transactions on Energy Conversion
- 6) IEEE Transactions on Power Delivery
- 7) IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE)
- 8) IET Power Electronics
- 9) Major IEEE conferences: APEC, IECON, PEDES, ISIE, ECCE, IAS Annual meeting etc.

REFEREES

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