

Mr. Juntao YAO

PhD Candidate, Focusing on Power Electronics and EMI Solutions

Research Assistant, Power Electronics and Electrical Power Research Lab (PEEPRL),

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Education

- PhD, Electrical Engineering, University of Florida, 2017-2021, Advisor: Dr. Shuo Wang
Thesis: Modeling and Reduction of Radiated Electromagnetic Interference in Power Converters
- MS, Electrical Engineering, Wuhan University, 2013-2016, Advisor: Dr. Fei Liu & Dr. Xiaoming Zha
Thesis: Operational Control for Photovoltaic-Storage based DC Microgrid
- BS, Electrical Engineering, Wuhan University, 2009-2013, GPA 3.66/4 (89/100), Ranking 22/392
Thesis: Compound Repetitive Control for LCL-filter based Active Power Filter

Skills

- **EMI Solutions for Power Electronics Systems** including conducted and radiated EMI in non-isolated and isolated power converters, in consumer electronics and automotive electronics, by improving the component (e.g. switching transformers, EMI filters) design and the PCB layout
- **Hardware-PCB design** in Altium Designer, design of switching power supplies and components, and testing using vector network analyzer, impedance analyzer, spectrum analyzer, power analyzer, oscilloscope, signal generator, etc.
- **Finite Element Simulation** in ANSYS Q3D, HFSS, and CST
- **Circuit Simulation** in Matlab Simulink, PSPICE, Saber, PSIM, and SIMPLIS
- **Programming** in Matlab, Code composer studio, Latex, and GitHub for web development

Research Experiences

Power Electronics and Electrical Power Research Lab (PEEPRL), University of Florida

- **EMI in Power Converters in Automotive Applications** Aug. 2018 -Present
Sponsored by Monolithic Power Systems, Inc. San Jose, CA, USA
 - Modeling of EMI in automotive DC-DC power converters including the analyses of switching noise sources, components, PCB layouts, and antennas
 - Developed a virtual lab for EMI predictions. With the PCB file imported to ANSYS/Q3D and ANSYS/HFSS, the parasitics in the power converter and the coupling parasitics between power converter and power cables are extracted. The radiation characteristics of the antenna consisting of power cables are extracted. The radiated EMI of the power converter system is predicted to emulate the testing in a semi-anechoic chamber.
 - Proposed EMI solutions by PCB layout improvement, capacitor improvement and near field coupling mitigation
- **Radiated EMI in GaN IC-based Active Clamp Flyback Adapters** Mar. 2018 - Oct. 2019
Sponsored by Navitas Semiconductor, Inc. El Segundo, CA, USA
 - Modeling of radiated EMI in GaN IC-based active clamp flyback adapters
 - Developed a finite element simulation model of the planar transformer based on ANSYS HFSS
 - Analyzed and mitigated near field couplings' impact on the radiated EMI
 - Proposed radiated EMI solutions based on improved shielding and EMI filter techniques, and the improved PCB layout
- **EMI in Flyback Adapters** Jan. 2017 - Dec. 2017
Sponsored by Huawei Technologies
 - Conducted and radiated EMI modeling including switching noise sources, the transformer, EMI filter components and the antenna

- EMI reduction by improving the transformer design, the snubber, and the inductors
- Improved the transformer winding structure based on the coaxial shielding technique

Center for Grid Power Electronics, Wuhan University

- **DC Microgrid** Sep. 2014 - June 2016
Sponsored by Smart Grid Research Institute of State Grid
 - Established a simulation model consisting of a grid-connected converter, a PV panel and loads
 - PCB layout of a grid connected converter
- **Regenerative Bidirectional Cascaded Multilevel Converter** June 2013 - June 2015
Sponsored by National Natural Science Foundation of China
 - Designed the hybrid power cell configuration
 - Proposed a method to estimate the power recycling capacity
- **Shunt Active Power Filter** Nov. 2012 - Aug. 2013
Bachelor thesis (Province-level honor)
 - Established an APF simulation model with a LCL filter
 - Proposed a multi-internal-model based repetitive controller robust to frequency fluctuation

Publications

Journal papers

1. **J. Yao**, S. Wang and H. Zhao, "Measurement Techniques of Common Mode Currents, Voltages, and Impedances in a Flyback Converter for Radiated EMI Diagnosis," in IEEE Transactions on Electromagnetic Compatibility, vol. 61, no. 6, pp. 1997-2005, Dec. 2019.
2. **J. Yao**, Y. Li, S. Wang, X. Huang, and X. Lyu, "Modeling and Reduction of Radiated EMI in a GaN IC-based Active Clamp Flyback Adapter," submitted to IEEE Transactions on Power Electronics. (Under Review)

Conference papers

1. **J. Yao**, Y. Li, Z. Ma and S. Wang, "Advances of Modeling and Reduction of Conducted and Radiated EMI in Flyback Converters," in 2020 IEEE Energy Conversion Congress and Exposition (ECCE), 2020.
2. **J. Yao**, S. Wang and Z. Luo, "Near Field Coupling's Impact on Radiated EMI and Mitigation Techniques for Power Converters in Automotive Applications," in 2020 IEEE Energy Conversion Congress and Exposition (ECCE), 2020.
3. **J. Yao**, S. Wang and Z. Luo, "Radiated EMI Reduction by Layout Improvement in Power Converters in Automotive Applications," in 2020 IEEE 9th International Power Electronics and Motion Control Conference (IPEMC2020-ECCE Asia), 2020, pp. 1-6.
4. **J. Yao**, Y. Li, S. Wang, X. Huang, and X. Lyu, "Analysis and Reduction of Radiated EMI in High-Frequency GaN IC-based Active Clamp Flyback Converters," in 2020 IEEE Applied Power Electronics Conference and Exposition (APEC), 2020, pp. 664-671.
5. **J. Yao**, S. Wang and Z. Luo, "Modeling and Reduction of Radiated EMI in Non-isolated Power Converters in Automotive Applications," in 2020 IEEE Applied Power Electronics Conference and Exposition (APEC), 2020, pp. 385-392.
6. **J. Yao**, M. El-Sharkh, Y. Li, Z. Ma, S. Wang, and Z. Luo, "Investigation of Radiated EMI in Non-isolated Power Converters with Power Cables in Automotive Applications," in 2019 IEEE Energy Conversion Congress and Exposition (ECCE), 2019, pp. 6957-6964.
7. Z. Ma, **J. Yao**, Y. Li, and S. Wang, "Comparative Analysis of Magnetic Core Loss Measurement Methods with Arbitrary Excitations," in 2019 IEEE Energy Conversion Congress and Exposition (ECCE), 2019, pp. 4125-4130.
8. Y. Li, **J. Yao**, and S. Wang, "Increase High Frequency Impedance of Ferrite Toroid Inductors Based on Electromagnetic Energy Analysis," in 2019 IEEE Energy Conversion Congress and Exposition (ECCE), 2019, pp. 6184-6191.
9. **J. Yao**, Y. Li, H. Zhao, and S. Wang, "Design of CM Inductor Based on Core Loss for Radiated EMI Reduction in Power Converters," in 2019 IEEE Applied Power Electronics Conference and Exposition (APEC), 2019, pp. 2673-2680.
10. H. Zhao, **J. Yao**, and S. Wang, "A Universal DM/CM Physical Model for Power Transformer EMI Analysis within both Conducted and Radiated Frequency Ranges," in 2018 IEEE Energy Conversion Congress and Exposition (ECCE), 2018, pp. 6592-6599.
11. **J. Yao**, Y. Li, H. Zhao, S. Wang, Q. Wang, Y. Lu, and D. Fu, "Modeling and Reduction of Radiated Common Mode Current in Flyback Converters," in 2018 IEEE Energy Conversion Congress and Exposition (ECCE), 2018, pp. 6613-6620.

12. **J. Yao**, S. Wang, H. Zhao, Y. Zhang, Q. Wang, Y. Lu, and D. Fu, "Measurement Techniques of CM Currents, Impedance and Voltages for Radiated EMI in Isolated Power Converters," in 2018 IEEE Symposium on Electromagnetic Compatibility, Signal Integrity and Power Integrity (EMC, SI & PI), 2018, pp. 438-443.
13. **J. Yao**, F. Liu, J. Gong, and X. Zha. "Power Recovery and Cost Reduction Oriented Optimization of Regenerative Cells Embedded in Cascaded Multilevel Converter", in Energy Conversion Congress and Exposition(ECCE), 2015, pp. 5117 - 5123.
14. **J. Yao**, F. Liu, J. Gong, and S. Li. "A Novel Partial Units Energy Feedback Cascaded Multilevel Inverter with Bypass Control", in International Future Energy Electronics Conference(IFEEC), 2013, pp. 494-499.

Patents

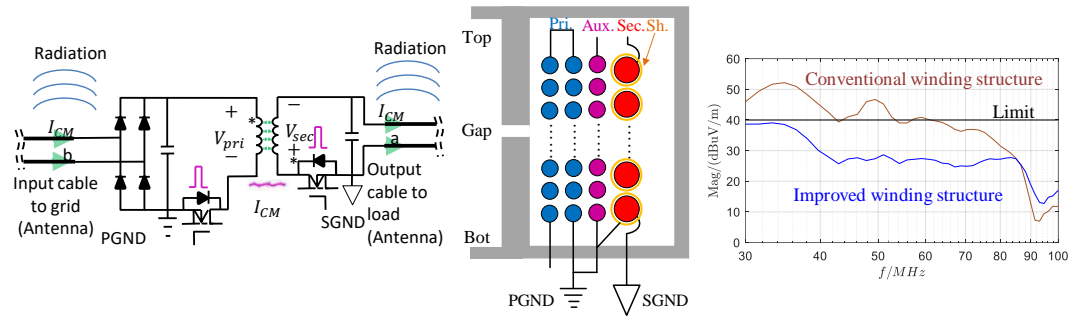
1. S. Wang, **J. Yao** and Y. Li, "New Common Mode (CM) Electromagnetic Interference (EMI) Filters for Reducing Radiated EMI in Power Converters," U.S. Patent, 62/950,268, Dec. 19, 2019 (Pending, U.S. patent)
2. Y. Xiong, F. Zhu, **J. Yao**, H. Yang, F. Liu. "A Rectifier-fed Cascaded Multilevel Converter for Dual Motor Drive," China Patent, CN204859024U, Aug. 24, 2015. (Issued)
3. F. Zhu, Y. Xiong, **J. Yao**, H. Yang, F. Liu. "A Symmetrical Three Port Cascaded Power Converter for Dual High Power Motor Drive," China Patent, CN204906233U, July 28, 2015. (Issued)
4. F. Liu, **J. Yao**, Y. Wang, K. Feng, C. Huang, X. Zha. "A Repetitive Controller with Multiple Internal Models Considering the Frequency Deviation of the Power System," China Patent, CN104836233A, May. 25, 2015. (Issued)
5. **J. Yao**, K. Deng, F. Liu, J. Gong, L. Xiong, X. Zha. "Partial Bidirectional Cells based Regenerative Cascaded Multilevel Converter and the Optimized Configuration of the Regenerative Cells", China Patent, CN104104240B, July 25, 2014. (Issued)
6. F. Liu, X. Lai, K. Deng, **J. Yao**, J. Sun, Y. Li. "A Solid-state Electronic Switch Based Short Circuit Protection Method for DC Microgrids," China Patent, CN103928912B, May. 8, 2014. (Issued)
7. F. Liu, X. Zha, K. Deng, **J. Yao**, J. Gong. "A Cascaded Multilevel Converter without Active Front for Dual Motor Drives," China Patent, CN103944439A, Apr. 28, 2014. (Issued)
8. **J. Yao**, G. Huang, C. Liu, W. Lyu, Y. Li, F. Liu, X. Zha. "A DC Microgrid," China Patent, CN202586339U, May. 18, 2012. (Issued)
9. G. Huang, **J. Yao**, C. Liu, W. Lyu, Y. Li, F. Liu, X. Zha. "Low-voltage Bipolar DC Micro-power Grid," China Patent, CN202586340U, May. 18, 2012. (Issued)
10. J. Sun, X. Zha, Y. Li, W. Lyu, C. Liu, G. Huang, **J. Yao**. "A Three Wire DC Microgrid System and Control Method for Modern Buildings," China Patent, CN102593832B, Mar. 15, 2012. (Issued)

Honors and Awards

- Excellent master graduate(Top 3%) , Wuhan University, 2016
- First-class scholarship, Wuhan University, 2014
- Excellent bachelor thesis of Hubei province(Top 2%), 2013
- Excellent graduate(Top 3%) , Wuhan University, 2013
- Honorable mention, US Mathematical Contest in Modeling/Interdisciplinary Contest in Modeling (US ICM/MCM), 2012
- All-round excellent student(Top 5%), Wuhan University, 2012
- Outstanding student leader, Wuhan University, 2012
- National encouragement scholarship(Top 5%), 2012
- 3rd Prize in the National Electrician Mathematical Modeling Contest, 2011
- Award for creative researcher, Wuhan University, 2011
- National encouragement scholarship(Top 5%), 2011

Appendix: Innovation Highlights

Project I: In Flyback Converters, Transformer Structure Optimization for Radiated EMI Reduction



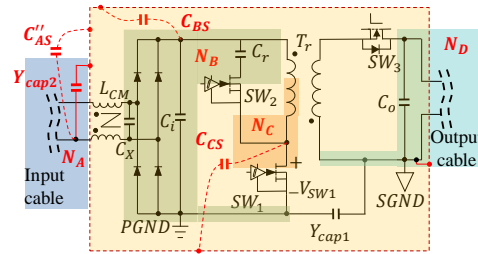
Radiated EMI in the flyback converter with power cables attached

Optimized transformer structure with improved coaxial shielding

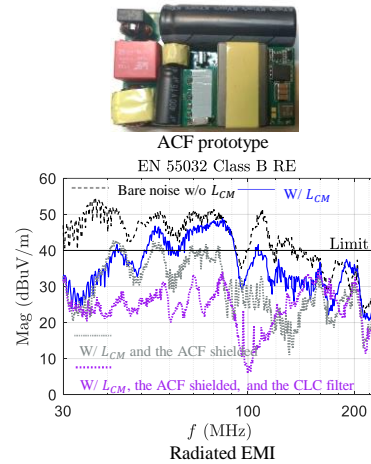
Radiated EMI

With the transformer optimized, radiated EMI is brought to compliance with the standard.

Project II: Radiated EMI in GaN IC-based Active Clamp Flyback Adapters

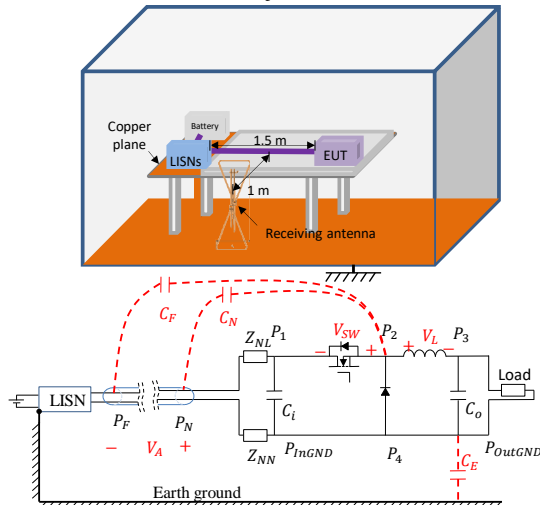


The proposed CLC filter combined with the shielding technique

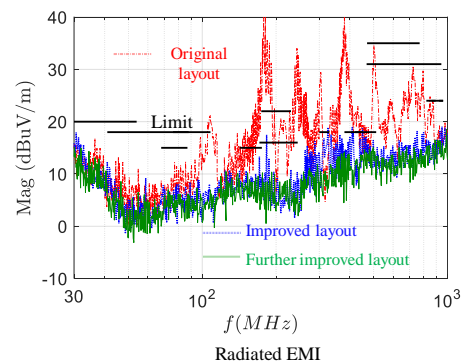


In the GaN IC-based ACF power adapter, the radiated EMI is brought into compliance after the application of the CLC filter combined with the shielding technique.

Project III: EMI in Power Converters in Automotive Applications



EMI compliance testing of automotive power converters



In automotive power converters, the radiated EMI is brought into compliance by improving the layout of components and traces.