

MINGDE ZHOU

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EDUCATION BACKGROUND

Shanghaitech University, Electronic science and technology, *Ph. D. candidate* 2021.9 - present

- Advisor: Prof. Haoyu Wang
- Research Interest: ad/dc converter, bidirectional power converter, resonant converter, magnetic design.

Shanghaitech University, Electronic science and technology, *Master student* 2019.9 - 2021.9

- **Specialized courses GPA 4.0/4.0**
- Advisor: Prof. Haoyu Wang
- Core curriculum: Power Electronics Converters Modeling and Control (A+), Advanced Power Conversion Techniques (A+), Power System (A+), Renewable Energy Systems (A+)
- Research Interest: bidirectional power converter, resonant converter

Shandong University, Automation, *Bachelor of engineering* 2015.9 - 2019.6

- **GPA 4.24/5.0 (No. 7 in the major)**. Graduate Admission Exemption
- Excellent Engineer Education and Training Program of Ministry of Education
- Outstanding Student Scholarship of Shandong University in 2016, 2017 and 2018

RESEARCH EXPERIENCE

Current Zero-Crossing Prediction Based Critical Conduction Mode Control of Totem-Pole PFC Rectifiers 2022.3-2023.3

- A novel current estimator is proposed for CRM control. The behaviors of the estimator considering the non-linear output capacitance of switching devices are modeled and analyzed;
- No current sensor, ZCD circuit, or ZVS-catch circuits are required. This reduces the component count of the peripheral circuits and the resistive losses in the power circuit;
- To improve the prediction performance, a disturbance damping control is proposed to mitigate the variation of inductance and parasitic resistance.
- The proposed current estimator provides information on both the instant current and average current. The noisy CRM current signal is excluded from the control loop;
- High power factor and high efficiency can be realized simultaneously. Valley-switching and zero-voltage switching are achieved;
- The proposed concept is naturally compatible with high-frequency GaN devices.

SiC Based Integrated Bidirectional Converter for PEV Charging 2021.5-2021.12

- Reusing the motor driver as power switches, motor windings as boost inductors;
- Continuous conduction mode is used with SiC devices to reduce the reverse recovery;
- Realizing G2V/V2G with low cost and compact size.

Active Thermal Balance Method without Temperature Sensor 2021.3-2021.8

- Thermal balance is widely used in multi-modular converters to extend system life and reliability;
- Realizing active thermal control with active power-loss control;
- Proposed method is verified on a two-module buck converter.

Bidirectional Laddered dc Transformer (DCX) for PEV Charging 2020.10-2021.4

- Bidirectional operation comes with the application of renewable power internet with electric vehicles;
- With the variable dc-link framework, the proposed converter can work near the resonant point while adapting to a wide battery voltage range;
- Model-based synchronous rectification reduces the loss of the rectifier during bidirectional operation;
- Proposing bidirectional six reconfigurable switch-patterns for the H5-bridge.

Totem-Pole Rectifier/Inverter Based on GaN 2020.1-2020.9

- Based on GaN technology, increase the switching frequency of the totem pole topology to reduce the size of ac/dc stage filters;
- Use critical conduction mode to reduce switching loss in high-frequency applications, and study the implementation of soft switching under bidirectional operation.

On-Board-Charger with Ultra-wide Voltage Gain Range

2019.6-2019.11

- For charging the deeply depleted battery, a wide voltage gain dc/dc converter based on LLC is proposed;
- LLC resonant converter is suitable for battery charging applications, but it has a wide voltage gain range and large conversion loss under traditional design;
- This topology uses H5 reconfigurable bridge to realize six modes reconfigurable charging.

48-V Bus Power Supply with Extra-wide Input Voltage Range

2019.2-2019.6

- The wide voltage range of the Li-ion battery challenges the 48V power supply for vehicle electrical appliances;
- Utilize full-bridge and half-bridge reconfiguration to squeeze the frequency modulation range of LLC resonant converter under ultra-wide input voltage range, thereby improving the converter efficiency;
- Use the synchronous rectification technology based on the drain-source voltage detection method to reduce the secondary side rectification loss.

TEACHING AND VOLUNTEER EXPERIENCES

Teaching Assistant

- Introduction to Information Science and Technology 2021.3 - 2021.6
 - Teach experiments and grade homework;
 - Communicate with students to solve their problems, and help them to improve.

Volunteer

- Outstanding Campers Open Day of SIST, ShanghaiTech University, CiPES Volunteer 2020.7
- Outstanding College Student Summer Camp ,ShanghaiTech University, CiPES Volunteer 2020.7
- Open Campus Day, ShanghaiTech University, CiPES Volunteer 2019.6

JOURNAL PAPERS

- (J6) **M. Zhou**, C. Peng, J. Liang, M. Fu and H. Wang, "Current Zero-Crossing Prediction Based Critical Conduction Mode Control of Totem-Pole PFC Rectifiers," in *IEEE Trans. Power Electron.*, early access.
- (J5) L. Wang, H. Wang, B. Xue, and **M. Zhou**, " H5-bridge based single-input-dual-output LLC converter with wide output voltage range," *IEEE Trans. Ind. Electron.*, vol. 69, no. 7, pp. 7008-7018, Jul. 2022.
- (J4) **M. Zhou**, D. Shu, H. Wang, " An H5-bridge Based Laddered CLLC DCX with Variable DC-link for PEV Charging Applications," *IEEE Trans. Power Electron.*, vol. 37, no. 4, pp. 4249-4260, Apr. 2022.
- (J3) F. Peng, Y. Lu, **M. Zhou**, and H. Wang, " Hierarchical Modular Battery Equalizer with Open-loop Control and Mitigated Recovery Effect" *CPSS Trans. Power Electron. Appl.*, vol. 6, no. 4, pp. 310-319, Dec. 2021.
- (J2) D. Shu, H. Wang, **M. Zhou**, "Universal Control Scheme to Achieve Seamless Dynamic Transition of Dual-Active-Bridge Converters Using Zero-Current Prediction," *IEEE Trans. Ind. Electron.*, vol. 69, no. 6, pp. 5826-5834, Jun. 2022.
- (J1) C. Li, **M. Zhou**, and H. Wang, "An H5-bridge based asymmetric LLC resonant converter with an ultra-wide output voltage range," *IEEE Trans. Ind. Electron.*, vol. 67, no. 11, pp. 9503-9514, Nov. 2020.

CONFERENCE PROCEEDINGS

- (C4) Z. Li, **M. Zhou**, H. Wang, " Temperature sensorless thermal management strategy for interleaving power converter," in *Proc. Int. Power Electron. Conf. (IPEC-ECCE Asia)*, Himeji, Japan, May 2022, pp. 466-470.
- (C3) **M. Zhou**, L. Yu, and H. Wang, " A SiC-Based highly integrated bidirectional AC/DC converter for PEV charging applications," in *Proc. IEEE Int. Power Electron. Appl. Symp. (PEAS)*, Shanghai, China, Nov. 2021.(**Won the best presenter award.**)
- (C2) **M. Zhou**, and H. Wang, "Design Methodology to Reduce the Intra-winding Capacitance of Spiral Winding Transformer in LLC converters", *IEEE Energy Convers. Congr. Expo. (ECCE)*, Vancouver, BC, Oct. 2021, pp. 5542-5548.
- (C1) **M. Zhou**, and H. Wang, "Optimal design of reconfigurable H5 bridge based LLC converter with ultra-wide input voltage range and synchronous rectification," in *Proc. IEEE Appl. Power Electron. Conf. Expo. (APEC)*, New Orleans, LA, Mar. 2020, pp. 2073-2080.

PATENT

- (P1) H. Wang, **M. Zhou**, "Variable/fixed bus voltage ultra-wide gain range bidirectional dc/dc converter," China, Patent Application No. 20201063521.4, submitted on March 10, 2020.

PROFESSIONAL SERVICES

Membership

- Student Member, IEEE 2020.1 - present
- IEEE Young Professionals 2020.1 - present
- Member, IEEE Power Electronics Society 2020.1 - 2020.12

Reviewer

- The Applied Power Electronics Conference (APEC) 2020, 2021
- IEEE Open Journal of the Industrial Electronics Society (OJIES) 2021 - present
- IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE) 2020 - present
- IEEE Transactions on Power Electronics (TPEL) 2020 - present
- IEEE Transactions on Transportation Electrification (TTE) 2020 - present