

# Xiang Zhang

Walter Light Hall, Room 108 (ePower Center),  
19 Union Street, Queen's University, Kingston, ON K7L 3N6  
✉ xiang.zhang@queensu.ca    🌐 xiangzhangpe.github.io    ☎ +1 (343)989-5489

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## EDUCATION

**Queen's University, Dept. Electrical and Computer Engineering, Kingston, Canada**

*Master of Applied Science, Advisors: Dr. Praveen Jain and Dr. Shangzhi Pan*

Jan. 2021 – Dec. 2023

GPA: 4.00 / 4.00

**Wuhan University, School of Electrical Engineering and Automation, Wuhan, China**

*Bachelors of Electrical Engineering, Advisor: Dr. Meng Huang*

Sep. 2016 – Jun. 2020

GPA: 89.33 / 100, Rank 27/304, Graduation with honor

**Mcmaster University, Dept. Electrical and Computer Engineering, Hamilton, Canada**

*International Exchange Student*

Jun. 2019 – Nov. 2019

One of 30 selected students across all undergraduates in Wuhan University funded by CSC

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## PUBLICATIONS & AWARDS

### Publicaitons:

1. [Draft] X. Zhang, S. Pan, and P. Jain, "Multiphase symmetrical coupled resonant converter: Enhanced current balancing and Rotation phase-shedding Control" Submitted to IEEE Transactions on Power Electronics.
2. [Draft] X. Zhang, S. Pan, and P. Jain, "Current sharing in multi-phase/multi-module converters: a technical review" prepared to be submitted to IEEE Transactions on Power Electronics.
3. [trans TPEL] X. Zhang, S. Pan, and P. Jain, "A Discrete Coupled Multiphase Interleaved LLC Converter With Symmetrical Components Analysis," IEEE Transactions on Power Electronics, vol. 38, no. 11, pp. 14150–14165, Nov. 2023, doi: 10.1109/TPEL.2023.3279822.
4. [ECCE' 2023] X. Zhang, S. Pan, P. Jain, "Discrete Symmetrical Coupled Inductor Structure and its Matrix-type Implementation for DC-DC Converter," in 2023 IEEE Energy Conversion Congress and Exposition (ECCE), Oct. 2023, pp. 3437–3444. doi: 10.1109/ECCE53617.2023.10362759..
5. X. Zhang, T. Li, S. Peng, C. Hu, R. Sun, and M. Huang, "Control system of Internet of Things energy router," Chinese Patent, CN209608395U, Nov. 08, 2019.

### Scholarships:

- NSERC Graduate Research Fellowship of Queen's university (\$23000/year, 2021-2023)
- Graduate Fellowship of Mitacs Globalink, Canada (\$15000, 2022)
- Outstanding undergraduate intern scholarship awarded by China Scholarship Council (\$5400, 2019)
- Scholarship of Academic Excellence of Wuhan University (Once a year, 2x first class, 5%, 1x second class 10%, 2017-2020)

### Awards:

- Prize for Outstanding Undergraduate Thesis of Wuhan University(15%)
  - First Prize in 2019 "The Challenge Cup Academic Competition" in Hubei Province (10%)
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## RESEARCH EXPERIENCE

### Discrete Symmetrical Coupled Magnetics application in Multi-phase Interleaved LLC Converters

Guide: Dr. Praveen Jain, Dr. Shangzhi Pan, Kingston, ON

May. 2022 – May. 2023

- Innovatively introduced the symmetrical components theory into high frequency resonant converters to explain the current sharing behavior of the mulitphase system, expanding the coupled magnetics application to all odd-phase interleaved resoannt converters, providing an assessment method of current balancing ability under sequence impedance;
- Proposed a magnetics coupling structure that inherently balances the current in the multiphase interleaved LLC converter, reducing the current sharing error from 40-60% to 2-5% in multiphase system;
- Implemented a complete control architecture that incorporates both enhanced current balancing algorithm and rotation phase-shedding operation, further reduce the current sharing error to 0.3-0.5% level with better thermal distribution.

### Precise Digital Control Architecture for Multi-phase Resonant Converter with Adaptive Voltage Positioning

Guide: Dr. Praveen Jain, Dr. Shangzhi Pan, Kingston, ON

Jun. 2021 – May. 2022

- Investigated the mechanisim of charge bang-bang control, state trajectory control in resonant converters, constructed a detailed time-series model of CLL and LLC resonant tank, with VHDL based control algorithm;
- Expanded the adaptive voltage positioning techniques from multi-phase buck converter to multi-phase resonant converter.

### Three-phase PV Micro Inverter with Power Decoupling Quad Active Bridge

Guide: Dr. Shangzhi Pan, Kingston, ON

Jul. 2020 – May. 2021

- Investigated and modeled magnetic power decoupling characteristic of quad active bridge structure, formulated a numerical based modulation algorithm for ripple cancellation to minimize the micro inverter capacitors' requirement;
- Carried out the verification experiment of the proposed three-phase micro inverter based on GaN switches, resolved driver design and corresponding testing problems of wide-band-gap devices.

## Modular Design of low-power Iot Smart Switch System

Guide: *Dr. Meng huang, Wuhan, China*

Nov. 2019 – May. 2020

- Designed a smart switch system with integrated flyback regulators, aiming for the smart home lighting application;
- Implemented a stable output voltage positioning using the programmed current controller with a feedback optocoupler;
- Constrained energy loss to mW criteria by deploying burst-mode control to providing intermittent operation;
- Installed replaceable Bluetooth modules to the system to achieve IoT versatile operational commands.

## Power System Dynamic Database

Guide: *Dr. Tang Chi, Hamilton, ON*

Jun. 2019 – Nov. 2019

- Organized and Reprocessed the dynamic data from online technical reports and government official documents referring bulk electrical system in Ontario to simplify the structure of Ontario power grids;
- Designed an adaptive online database to sort, store and modify the changing data in Mysql;
- Coded a users' interface program to export information from the database to PSS/E using python and SQL;
- Verified the dynamic model under system disturbance and proposed an optimum generation planning for the current Ontario power grid in PSS/E software.

## Controlling Strategy for DC Micro-grid with Multi-port Converter

Guide: *Dr. Meng huang, Wuhan, China*

Jan. 2018 – Jul. 2019

- Modeled and analyzed the stability of the system with rapidly changing load and nonlinear load, hardware verification are implemented with single DC bus with paralleled DC-AC inverters and DC-DC converters, and ARM-FPGA co-processor;
- Tested Droop and P&O and MPPT control strategies for cascaded converters under islanded mode and grid-tied mode;
- Compiled control strategies based on C language with high-speed ADC with a DMA controller, ameliorated the system by attaching a communication platform to the microgrid, under Modbus protocol.

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## WORK EXPERIENCE

**SPARQ SYSTEMS Inc**, 945 Princess Street, Kingston, ON, K7L 0E9

Testing Engineer

Aug. 2022 – Jun. 2023

- Responsible for the massive production burning test design and setup for the industrial Quad-2000 micro inverter;
- Performed as overseas communicator for factory manufacture, user manual, datasheet proofreading and translation.

**HUAWEI Digital Power Technologies Co. Ltd**, Wuhan, China

Hardware Application Intern

Aug. 2020 – Nov. 2020

- Completed process of single-board hardware development from component selection, schematic design to SDV testing.

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## TEACHING & SERVICE

**Journal Reviewer:** IEEE Transactions on Power Electronics

**Teaching Assistant:** ELEC371: Microprocessor Interfacing and Embedded Systems, Queensu, 2022; APSC200: Engineering Design and Practice II, Queensu, 2021

**Community:** Undergraduate summer exchange intern with Wuhan University and Cambridge University (Language, Culture & Society Track), 2017; Debate club leader in School of Electrical and Automation Engineering, Wuhan University, 2016-2018; Representative of external affairs department in students' union, Wuhan University, 2017-2018

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## SKILLS & OTHERS

**Programming Skills:** Excellent in C/C++, Proficient in Python, VHDL/Verilog, SQL, and JavaScript

**Hardware Skills:** TI C2000 DSP, STM32 M3/4, Altera/Xilinx FPGA, Zynq, Arduino

**Software Skills:** Matalab, Simulink, LabVIEW, PSIM, SIMPLIS, LTSPICE, PLECS, PSS/E, PSCAD, Altuim Designer, PSS/E, ANSYS Maxwell, SolidWorks

**Research Interests:** Resonant Converter, Current Sharing, Symmetrical Coupled Magnetic, High precision digital Control

**Language Capability:** TOEFL 108(S22), GRE 323/ V154(64%)/ Q169(95%)/ Aw 3.5(39%)