

Heshou (Herschel) Wang

Curriculum Vitae

Personal data

Name in English: Heshou (Herschel) WANG
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IEEE Membership: *IEEE Senior Member* (ID: 97538850; R10 Hong Kong Section)
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Researcher Identifier: [ResearchGate](#) [Google Scholar](#)



EDUCATION AND ACADEMIC DEVELOPMENT

- 2022 **Doctor of Philosophy, Electrical Engineering, The Hong Kong Polytechnic University (QS:57)**
- Supervisor: **Prof. Eric CHENG**, *IEEE Fellow*
 - Thesis title: Magnetic Coupler Design in Wireless Power Transfer for Vehicular Applications
 - Panel of the Viva: **Prof. Keyue Smedley**, *IEEE Fellow*, and **Prof. Chi-Kwan Lee**
 - This thesis investigates specialized magnetic couplers for wireless power transfer (WPT) systems in vehicular applications, focusing on improving transferability and system robustness. It presents different coil structures such as the three-coil WPT system, DDQ coil, Helmholtz resonator, dynamic charging arrays that ensure load-independent outputs and reduce unwanted couplings.
 - Moreover, it explores double-receiver systems for automatic guided vehicles and introduces a dynamic WPT approach for electric trains using segmented transmitter technology to enhance power delivery. These advancements, validated through simulations and experimental tests, offer significant improvements in wireless charging systems.
 - Noticeably, the main technologies proposed in this thesis have been successfully transferring to famous companies such as **MTR Corporation** (#1 for public transit among 60 cities worldwide), **Wuling Motors** (The **third**-largest electric vehicle manufacturer globally).
- 2018 **Master of Science in Electrical Engineering, The Hong Kong Polytechnic University (QS:57)**
- Supervisor: **Prof. Weinong FU**
 - Thesis title: Integrated optimal design of permanent magnet in-wheel motors
 - Student representative in Student Staff Consultative Group (Only 2 students per year)
- 2015 **Bachelor of Engineering in Electrical Engineering, Harbin University of Science and Technology**
- Supervisor: **Prof. Qingguo CHEN**, *Vice President (Research and Innovation)*
 - Outstanding student in Heilongjiang Province (Top 1%)

✧ **Three Most Representative Publications**

- 2023 **Analysis, Design, and Validation of a Decoupled Double-Receiver Wireless Power Transfer System with Constant Voltage Outputs for Industrial Power Supplies (IEEE-TII)**
- This study presents a magnetic coupler for **double-receiver** wireless power transfer systems that **greatly reduces unwanted cross-couplings** using orthometric DD and Q-shaped coils. The system demonstrates a constant **72 V output** and a peak dc-dc efficiency of **90.16%** with a 12

cm air gap, delivering 518.4 W to two 20 Ω loads.

- 2022 **A New Resonator Design for Wireless Battery Charging Systems of Electric Bicycles (IEEE-JESTPE)**
- This paper introduces a novel resonator design for wireless battery charging in electric bicycles using a switched **S-SP/S compensation** scheme paired with **Helmholtz coils**. The Helmholtz coils ensure stable mutual inductance between the transmitting and receiving coils, allowing for load-independent **constant current** (CC) and **constant voltage** (CV) charging.
- 2021 **A Special Magnetic Coupler Structure for Three-Coil Wireless Power Transfer: Analysis, Design, and Experimental Verification (IEEE-TMAG)**
- This paper introduces a novel magnetic coupler for **three-coil** wireless power transfer systems, designed to eliminate mutual inductance between the source and receiver coils, thus enhancing design flexibility. The coupler features a unipolar Q coil for the source, a mixed QDD coil for the transmitter, and a bipolar DD coil for the receiver. This configuration **magnetically isolates the receiver from the source**, maintaining **high efficiency** even **under lateral misalignment**.

TEACHING EXPERIENCE

(Good at Courses such as Power/Analog/Digital Electronics, Electric Vehicles, Circuitry, and Electromagnetics)

Since 2016, I have been working as a Teaching Assistant, Lab Assistant, and students in numerous courses at PolyU. As for the teaching plans, I can conduct various courses independently like *Electric Vehicles, Autonomous Vehicles, Circuitry, Electromagnetics and Applications, Power Electronics* for undergraduate/ graduate students.

- 2021 **Teaching Excellence** at EE Department in The Hong Kong Polytechnic University: **Only 3 Best TAs** can get this award **each year**.
- 2023 **Teaching Assistant** in EE548 Advanced Electric Vehicle Technology with Prof. Eric Cheng
- PowerPoints Preparation, Conducting Tutorials, Conducting Lab Sessions, and Mentoring Students.
- 2022 **Teaching Assistant** in Training Course for Hong Kong Electrical and Mechanical Services Department (EMSD) with Prof. Eric Cheng
- Contributing to Curriculum Planning, Making Tutorials, Assisting with Lecture Preparation.
- 2022 **Teaching Assistant** in EE547 Electric Vehicle Charging Systems with Prof. Eric Cheng
- Conducting Tutorials or Labs, Resolving Student Issues, Provide academic support to students.
- 2021 **Teaching Assistant** in EE512 Electric Vehicles with Prof. Eric Cheng
- Facilitating Discussions, Making Tutorials, PPT preparation, Provide academic support to students.
- 2021 **Teaching Assistant** in EE3003 Power Electronics and Drives with Dr. K.H. Lam
- Support students in need, Lecture Support, PPT preparation, Laboratory Assistance.
- 2019 **Teaching Assistant** in EE512 Industrial Power Electronics with Dr. Jiefeng Hu
- Course Administration, Making Tutorials, Provide academic support to students, PPT preparation.
- 2019 **Teaching Assistant** in EE510 Electrical Traction Engineering with Prof. Weinong Fu
- Facilitating Online Learning, Feedback Provision, Provide academic support to students.
- 2018 **Teaching Assistant** in EE3003 Analogue and Digital Circuits with Dr. Roland Ip
- Support for Diverse Learning Needs, Promoting Academic Integrity, Monitoring Student Progress.
- 2024 **Instructor** at Underwater unmanned Systems Challenge in Hong Kong. Train and help primary and secondary school students to design and build Remote Operated Vehicles (ROVs).
- 2022 **Team Leader** for IEEE Global Student Wireless Power Competition with Dr. Yun Yang
- Guide junior students in EE department.

- 2019 **BETA Certificate** (Becoming an Effective Teaching Assistant), which officially trains to be a professional to present tutorials, guide students, and get the ability to well design lecture notes.
- 2012 **BETA Certificate** (Becoming an Effective Teaching Assistant), which officially trains to be a professional to present tutorials, guide students, and get the ability to well design lecture notes.

INVITED TALK

- The Chinese University of Hong Kong, Dec 2023. Topic: Wireless Power Transfer Technology, Invited by **Prof. Benzhong TANG**, academician of Chinese Academy of Sciences. (*Academician of Chinese Academy of Sciences*).
- Fuzhou University, Jan 2024. Topic: Wireless Power Transfer Technology, Invited by **Prof. Yiming ZHANG**, Excellent Young Scientists. (*National talent*)

GRANTS & PROJECTS

- 2023 **Innovation and Technology Fund:**
Smart Refrigeration Truck Development Program - Power, Solar and Intelligence Method for Logistics and Storage.
- Fund amount: 4,933,500 HKD
 - Project Number: ITS/011/22MS
 - Duration: 06/2023-11/2025
 - Duty: ITF-RTH Postdoctoral Fellow (Current Job)
- 2024 **General Research Fund:**
Coupling investigation of wireless power transfer for super high-speed vehicles.
- Duty: Key Researcher
- 2022 **Innovation and Technology Fund:**
Development of Fixed-route Autonomous Driving for Light Vehicles with Smart Steering and Enhanced Power Regeneration - The Ultimate Solution for Smart Steering and Smart Energy Management.
- Fund amount: 3,510,541 HKD.
 - Project Number: ITP/047/21AP
 - Duration: 03/2022-03/2024
 - Duty: ITF-RTH Postdoctoral Fellow
- 2020 **Procore - France/Hong Kong Joint Research Scheme:**
Development of Novel Wireless Charging Technology for Electric Vehicles Without Any Data Communication.
- Co-supervisor: **Prof. Fei Gao**, *IEEE Fellow*, UTBM, France,
 - Project Number: F-PolyU503/19
 - Duration: 02/2020-01/2023
 - Duty: Key Researcher
- 2018 **Innovation and Technology Fund:**
Dynamic Wireless High Power Transfer For Next Generation Of Electric Trains.
- Fund amount: 1,396,100 HKD

- Project Number: ITP/047/21AP
- Duration: 07/2018-12/2019
- Duty: Key Researcher

2024 The Next-generation Autonomous Guided Vehicle (L4) Featured with Wireless Charging and Cruise

- Project Number: PolyU24-04
- Duration: 01/2024-01/2025
- Amount: 120,000 HKD
- Duty: **Principal Investigator (PI)**

2024 Three Phase Balancer

- Project Number: PolyU25-121
- Duration: 11/2024-01/2026
- Amount: 120,000 HKD
- Duty: **Principal Investigator (PI)**

Award

- **Best Reporter** – 中國電源協會, 2019
- **Teaching Excellence** – The Hong Kong Polytechnic University 2020, 2021
- **Merit With Mention** – IEEE PESA Conference, Hong Kong, 2020, 2022
- **[Second Place Prize, IEEE Transactions on Power Electronics on Power Electronics, 2024](#)**

WORK EXPERIENCE

The Hong Kong Polytechnic University (QS: 57)

- Postdoctoral Fellow (ITF-RTH Grant) (2022.09-now)
- Research Intern (2018.05-2019.01)

Nanyang Technological University (QS: 15)

- Visiting Research Fellow (2024.09-now)

Shenzhen Didimei Environmental Technology Limited

- Senior Engineer (2015-2019)

NovelTec Limited Hong Kong

- Founder (2024-now)

PROFESSIONAL SERVICES

Memberships

- Senior Member (ID: 97538850), Institute of Electrical and Electronics Engineers (IEEE)
- Member, IEEE Industrial Electronics Society (IES)

- Member, IEEE Power Electronics Society (PELS)
- Member, IEEE Vehicular Technology Society (VTS)
- Member, IEEE Power & Energy Society Membership (PES)
- Member, IEEE Hong Kong Section Chapter
- Member, IEEE Magnetics Society
- Member, PolyU Staff Club

Editorship and Chairmanship

2024	Associate Editor
	- <u>Wireless Power Transfer (WPT)</u> , Maximum Academic Press.
2023	Guest Editor
	- <u>IET Power Electronics: Advanced Technologies for Next-Generation Wireless Power Transfer</u> .
2023	Guest Editor
	- <u>Energies: Advances in Wireless Power Transmission Techniques for Electric Vehicle Charging Applications</u> .
2023	Guest Editor
	- <u>Electronics: Advanced DC-DC Converter Topology Design, Control, Application</u> .
2021	Session Chair
	- International Conference on Mechanical Engineering and Vehicle Engineering (MEVE).
2025	Technical Committee
	- 7th Asia Energy and Electrical Engineering Symposium (<u>AEEES 2025</u>).
2024	Partnership Chair
	- International Conference on 10th Power Electronics Systems and Applications (<u>PESA</u>).
2020-2022	Executive Committee
	- International Conference on 8 & 9th Power Electronics Systems and Applications (<u>PESA</u>).

Invited Reviewer for Journal Papers

- IEEE Transactions on Industrial Electronics (TIE)
- IEEE Transactions on Power Electronics (TPEL)
- IEEE Transactions on Industrial Informatics (TII)
- IEEE Transactions on Transportation Electrification (TTE)
- IEEE Transactions on Energy Conversion (TEC)
 - ✧ Star Reviewer 2023 (The Star Reviewers are recognized by the Editorial Board as the individuals who have consistently provided rigorous quality reviews in a timely fashion and on multiple occasions within a given year.)
- IEEE Internet of Things Journal (IoT)
- IEEE Transactions on Vehicular Technology (TVT)
- IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE)
- IEEE ACCESS
- Scientific Reports

SELECTED PUBLICATION LIST

Since 2018, I have published more than **30** SCI journal and conference papers, with **8** IEEE Transactions papers as first author and **4** IEEE Transactions papers as corresponding author. ([Google citation](#): 536 ; h-index: 12)

➤ **Journal Publications as the First Author**

- [1] **H. S. Wang** and K. W. E. Cheng, "Analysis, Design, and Validation of a decoupled Double-receiver Wireless Power Transfer System with Constant Voltage Outputs for Industrial Power Supplies," in *IEEE Transactions on Industrial Informatics*, vol. 19, no. 1, pp. 362-370, Jan. 2023. (IF: 12.3)
- [2] **H. S. Wang**, K. W. E. Cheng and Y. Yang, "A New Resonator Design for Wireless Battery Charging Systems of Electric Bicycles," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 10, no. 5, pp. 6009-6019, Oct. 2022. (IF: 5.5)
- [3] **H. S. Wang**, K. W. E. Cheng, X. Li and J. Hu, "A Special Magnetic Coupler Structure for Three-Coil Wireless Power Transfer: Analysis, Design, and Experimental Verification," in *IEEE Transactions on Magnetics*, vol. 57, no. 11, pp. 1-8, Nov. 2021. (IF: 2.1)
- [4] **H. S. Wang** and K. W. E. Cheng, "A Dual-Receiver Inductive Charging System for Automated Guided Vehicles," in *IEEE Transactions on Magnetics*, vol. 58, no. 8, pp. 1-5, Aug. 2022. (IF: 2.1)
- [5] **H. S. Wang**, Y. Wu, X. Li, X. Dai, Y. Sun and J. Hu, "Advanced Magnetic Coupler Design With Multi-Directional Anti-Misalignment Capabilities for Wireless Charging Unmanned Aerial Vehicles," in *IEEE Trans on Circuits and Systems II*, 2023. (IF: 4.4)
- [6] **H. S. Wang** and K. W. E. Cheng, "An Improved and Integrated Design of Segmented Dynamic Wireless Power Transfer for Electric Vehicles," *Energies*, vol. 14, no. 7, p. 1975, 2021. (IF: 3.2)
- [7] **H. S. Wang**, J. Sun and K. W. E. Cheng, "An Inductive Power Transfer System with Multiple Receivers Utilizing Diverted Magnetic Field and Two Transmitters for IoT-level Automatic Catering Vehicles," in *IEEE Transactions on Magnetics*, 2023. (IF: 2.1)
- [8] **H. S. Wang**, J. Sun and K. W. E. Cheng, "A Compact and Integrated Magnetic Coupler Design with Cross-coupling Elimination Utilizing LCC-S Compensation Network for Building Attached Photovoltaic Systems," in *IEEE Transactions on Magnetics*, 2023. (IF: 2.1)

➤ **Journal Publications as the Corresponding Author (Excellent Supervision Ability)**

- [1] X. Li, F. Zheng, **H. S. Wang***, X. Dai, Y. Sun and J. Hu, "Analysis and Design of a Cost-Effective Single-Input and Regulatable Multioutput WPT System," in *IEEE Transactions on Power Electronics*, vol. 38, no. 6, June 2023. (IF: 6.7)
- [2] X. Li, F. Zheng, **H. S. Wang***, Y. Sun, X. Dai, Y. Sun and J. Hu, "A Simultaneous Power and Data transfer Method for Dynamic Wireless Charging Electric Vehicles," in *IEEE Journal of Emerging and Selected Topics in Power Electronics*. (IF: 5.5)
- [3] Xiaofei Li, Zhiheng Li, Udaya K. Madawala, **H. S. Wang***, Yue Sun, Xin Dai, and Jiefeng Hu, "A Simultaneous Wireless Power and Data Transfer Method Utilizing a Novel Coupler Design for Rotary Steerable Systems," in *IEEE Transactions on Power Electronics*, vol. 39, no. 9, pp. 11824-11833, Sept. 2024.
- [4] X. Li, F. Yu, Udaya K. Madawala, **H. S. Wang*** et al, "A Dual-coupled Double-LCC System with the Capability of Misalignment Tolerance Improvement for Wireless Charging Substation Inspection Robots," in *IEEE Transactions on Power Electronics*, 2024. (IF: 6.7)

➤ **Selected Conference Proceedings as the First Author**

- [1] **H. S. Wang** and K. W. E. Cheng, "A Cost-effective Magnetic Coupler Design with Hexagonal Coils for Electric Vehicle Wireless Charging Systems," 2022 IEEE 9th International Conference on Power

Electronics Systems and Applications (PESA), 2022

- [2] **H. S. Wang** and K. W. E. Cheng, "Conical Coil Design for Domino Wireless Power Transfer," *2022 IEEE 20th Biennial Conference on Electromagnetic Field Computation (CEFC)*, Denver, CO, USA, 2022.
- [3] **H. S. Wang** and K. W. Eric Cheng, "A Special Magnetic Coupling Structure Design for Wireless Power Transfer Systems," *2022 IEEE 20th Biennial Conference on Electromagnetic Field Computation (CEFC)*, Denver, CO, USA, 2022.
- [4] **H. S. Wang**, S. Zhuo, F. Gao, E. Breaz, A. Gaillard and K. W. Eric Cheng, "An Integrated Design of Cost-effective Bipolar Hexagonal Coil and Active Disturbance Rejection Control for Wireless Power Transfer," *Transportation Electrification Conference & Expo*, 2023.
- [5] **H. S. Wang** and K. W. Eric Cheng, "An Intermediate-Coil and Ferrite-Based Coupling Structure With Load-Independent Constant Outputs for Inductive Power Transfer," *Power Electronics and Application Symposium (PEAS)*, Shanghai, China, 2021.
- [6] **H. S. Wang** and K. W. Eric Cheng, "A Cost-effective Magnetic Coupler Design with Hexagonal Coils for Electric Vehicle Wireless Charging Systems," *Power Electronics Systems and Applications (PESA)*, HK, 2022. **(Merit with mention award)**
- [7] **H. S. Wang**, K. W. E. Cheng, and J. F. Hu, "A Compact Design for a Switchable Wireless Charger," in *2020 8th International Conference on Power Electronics Systems and Applications (PESA)*, 7-10 Dec. 2020, pp. 1-6. **(Merit with mention award)**

➤ **Selected Collaborative Journal Publications (Great Collaboration with Local and International Teams)**

- [1] X. Li, C. Wang, **H. S. Wang**, X. Dai, Y. Sun and A. P. Hu, "A Robust Wireless Power Transfer System With Self-Alignment Capability and Controllable Output Current for Automatic-Guided Vehicles," in *IEEE Transactions on Power Electronics*, vol. 38, no. 10, pp. 11898-11906, Oct. 2023.
- [2] Hebing Liu, Jinhong Sun, **Heshou Wang**, K.W.E. Cheng, "Comprehensive Analysis of Adaptive Soft Actor-Critic Reinforcement Learning-Based Control Framework for Autonomous Driving in Varied Scenarios," *IEEE Transactions on Transportation Electrification*, accept. (IF: 7.2)
- [3] Jinhong Sun, Hebing Liu, **Heshou Wang**, K.W.E. Cheng, "Energy-Efficient Trajectory Optimization for Autonomous Driving Systems with Personalized Driving Style" in *IEEE Transactions on Industrial Informatics*, accept. (IF: 12.3)
- [4] X. Li, J. Hu, Y. Li, **H. S. Wang**, M. Liu, and P. Deng, "A Decoupled Power and Data-Parallel Transmission Method With Four-Quadrant Misalignment Tolerance for Wireless Power Transfer Systems," *IEEE Transactions on Power Electronics*, vol. 34, 2019. (IF: 6.7)
- [5] X. Li, X. Li, J. Hu, **H. S. Wang**, X. Dai, and Y. Sun, "A New Coupling Structure and Position Detection Method for Segmented Control Dynamic Wireless Power Transfer Systems," *IEEE Transactions on Power Electronics*, vol. 35, no. 7, pp. 6741-6745, 2020. (IF: 6.7)
- [6] X. Li, **H. S. Wang**, F. Zheng, X. Dai, Y. Sun and A. P. Hu, "Wireless Charging of Substation Inspection Robots Based on Parameter Estimation Without Communication," in *IEEE Transactions on Circuits and Systems II: Express Briefs*. Early Access. (IF: 4.4)