

Dr. Junrui LIANG (梁俊睿)

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Educations

Ph.D. in Mechanical and Automation Engineering (Advisor: Prof. Wei-Hsin Liao)
Department of Mechanical and Automation Engineering Aug. 2007 – Sep. 2010
The Chinese University of Hong Kong Hong Kong
Thesis title: *A systematic investigation on piezoelectric energy harvesting with emphasis on interface circuits*

M.S. in Precision Instrument and Machinery (Advisor: Prof. Chunyu Zhao)
School of Electronics, Information and Electrical Engineering Sep. 2004 – Mar. 2007
Shanghai Jiao Tong University Shanghai, China
Thesis title: *A research on class-E amplifier principle and its application on transcutaneous power link*

B.S. in Instrumentation Engineering (Advisor: Prof. Cai Ping)
School of Electronics, Information and Electrical Engineering Sep. 2000 – Jul. 2004
Shanghai Jiao Tong University Shanghai, China
Thesis title: *Correlation technology based velocity detecting device*

Working Experiences

Assistant Professor
School of Information Science and Technology Nov. 2013 – present
ShanghaiTech University Shanghai, China

Visiting Scholar (Host faculty member: Prof. Seth R. Sanders)
Department of Electrical Engineering and Computer Sciences Jul. 2015 – Jan. 2016
University of California, Berkeley California, USA

Visiting Scholar (Host faculty member: Prof. Wei-Hsin Liao)
Department of Mechanical and Automation Engineering Jun. 2015 – Jul. 2015
The Chinese University of Hong Kong Hong Kong

Postdoctoral Researcher (Advisor: Prof. Henry S.-H. Chung)
Centre for Smart Energy Conversion and Utilization Research Jan. 2013 – Oct. 2013
City University of Hong Kong Hong Kong

Postdoctoral Researcher (Advisor: Prof. Wei-Hsin Liao)
Department of Mechanical and Automation Engineering Oct. 2010 – Dec. 2012
The Chinese University of Hong Kong Hong Kong

Teaching Experiences

Instructor

Introduction to Embedded Systems (undergraduate) Fall 2016 & Spring 2017 @ ShanghaiTech
Embedded Systems Project (undergraduate) Summer 2017 @ ShanghaiTech

Industrial Survey (undergraduate)	Summer 2016 @ ShanghaiTech
Renewable Energy Systems (graduate)	Spring 2018, Spring 2016, Fall 2016, & Spring 2015 @ ShanghaiTech
Introduction to Information Science and Technology (undergraduate, co-instructor)	Spring 2015 @ ShanghaiTech
Analog Integrated Circuits (graduate)	Spring 2014 & Fall 2014 @ ShanghaiTech
Technical Writing in English (graduate, co-instructor)	Fall 2013 @ ShanghaiTech

Teaching Assistant

Engineering Profession (undergraduate)	Fall 2009 @ CUHK
Smart Materials and Structures (graduate)	Spring 2009 @ CUHK
Introduction to Control Systems (undergraduate)	Fall 2008 @ CUHK
Manufacturing Technology (undergraduate)	Spring 2008 @ CUHK
Introduction to Control Systems (undergraduate)	Fall 2007 @ CUHK

Honors and Awards

- Postgraduate Research Output Award 2010, The Chinese University of Hong Kong Dec. 2011
(only one postgraduate student, who produced the best research output within every past year, might be nominated by the Dean of each Faculty)
- Best Information Paper Award, 2010 IEEE International Conference on Information and Automation Jun. 2010
- Best Paper Award in Automation, 2009 IEEE International Conference on Information and Automation Jun. 2009
- Best Student Contributions Award, the 19th International Conference on Adaptive Structures and Technologies Dec. 2008
- Honor for the 9th Shanghai 21st Century Mechatronic Final Year Project Contest May 2004
- Excellent Student Award, Shanghai Jiao Tong University Nov. 2003
- Second Prize in Shanghai Region, 2003 National Electronic Design Contest Nov. 2003
- Academic Scholarship 2003, Shanghai Jiao Tong University Sep. 2003
- Excellent League Member, Shanghai Jiao Tong University May 2002

Research Interests

- *Energy conversion and power conditioning circuits*: Efficient energy conversions from one form to another within the electrical domain or across different physical domains, e.g., electrical, mechanical, thermal, and their implementations with power conditioning electronics. Development of the efficient algorithm for the simulation, evaluation, and optimization of power conversion circuits and systems.
- *Kinetic energy harvesting & vibration suppression*: Theories and practical implementations about how to better capture, store, and utilize the energy from ambient kinetic sources, such as human motions and vibrations, as well as the reactive impact of energy harvesting on kinetic sources.
- *Mechatronics*: Design and control of mechatronic systems, robotics, and embedded systems.
- *Piezoelectric devices*: Design and analysis of different types of sensors, actuators, and generators using piezoelectric materials.

- *Renewable energy*: Theoretical understanding on the physical insights of different renewable energy. Practical implementations for better exploitation, transmission, and utilization of renewable energy.

List of Publications

Journal Papers

- J15 Junrui Liang*, Yuheng Zhao, and Kang Zhao, “Synchronized triple bias-flip interface circuit for piezoelectric energy harvesting enhancement,” *IEEE Transactions on Power Electronics*, in revision.
- J14 Liya Zhao, Lihua Tang, Junrui Liang, and Yaowen Yang, “Synergy of wind energy harvesting and synchronized switch harvesting interface circuit,” *IEEE/ASME Transactions on Mechatronics*, vol. 22, no. 2, pp. 1093-1103, 2017.
- J13 Junrui Liang*, “Synchronized bias-flip interface circuits for piezoelectric energy harvesting enhancement: a general model and prospects,” *Journal of Intelligent Material Systems and Structures*, pp. 339–356, no. 3, vol. 28, 2017.
- J12 Haili Liu, Junrui Liang*, and Cong Ge, “A mechatronic power boosting design for piezoelectric generators,” *Applied Physics Letters*, vol. 107, no. 14, art. no. 141902, 2015.
- J11 Junrui Liang*, Henry Shu-Hung Chung, and Wei-Hsin Liao, “Dielectric loss against piezoelectric power harvesting,” *Smart Materials and Structures*, vol. 23, no. 9, art. no. 092001, 2014.
- J10 Junrui Liang and Wei-Hsin Liao*, “Impedance modeling and analysis for piezoelectric energy harvesting systems,” *IEEE/ASME Transactions on Mechatronics*, vol. 17, no. 6, pp. 1145-1157, 2012.
- J09 Junrui Liang and Wei-Hsin Liao*, “Improved design and analysis of self-powered synchronized switch interface circuit for piezoelectric energy harvesting systems,” *IEEE Transactions on Industrial Electronics*, vol. 59, no. 4, pp. 1950–1960, 2012.
- J08 Junrui Liang and Wei-Hsin Liao*, “Impedance network for power optimization in piezoelectric energy harvesting systems,” *HKIE Transactions*, vol. 18, no. 4, Dec. 2011. (Shortlisted paper for the *HKIE Outstanding Paper Award for Young Engineers/Researchers 2011*)
- J07 Junrui Liang* and Wei-Hsin Liao, “Steady-state simulation and optimization of class-E power amplifiers with extended impedance method,” *IEEE Transactions on Circuit and System I: Regular Papers*, vol. 58, no. 6, pp. 1433–1445, 2012.
- J06 Junrui Liang and Wei-Hsin Liao*, “On the influence of transducer internal loss in piezoelectric energy harvesting with SSHI interface,” *Journal of Intelligent Material Systems and Structures*, vol. 22, no. 5, pp. 503–512, 2011.
- J05 Tianliang Yang, Junrui Liang, Chunyu Zhao, and Dayue Chen*, “Analysis and design of Class-E power amplifiers at any duty ratio in frequency domain,” *Analog Integrated Circuits and Signal*, vol. 67, no. 2, pp. 149–156, 2011.
- J04 Junrui Liang and Wei-Hsin Liao*, “Energy flow in piezoelectric energy harvesting systems,” *Smart Materials and Structures*, vol. 20, no. 1, art. no. 015005 (11 pages), 2011. (One of the top 20 most cited articles published by *Smart Materials and Structures* in 2011)
- J03 Junrui Liang and Wei-Hsin Liao*, “Piezoelectric energy harvesting and dissipation on structural damping,” *Journal of Intelligent Material Systems and Structures*, vol. 20, no. 5, pp. 515–527, 2009.

- J02 Yulong Zhu, Junrui Liang, Haoran Bi, and Ping Cai*, “The design and development of teaching apparatus for correlation velocity measurement technique,” *Experiment Science and Technology* (in Chinese), no. 11, pp. 17–18, 2007.
- J01 Junrui Liang and Chunyu Zhao*, “A design of transcutaneous power link circuit,” *Application of Electronic Technique* (in Chinese), no. 4, pp. 87–89, 2007.

Conference Papers

- C27 Bao Zhao, Junrui Liang*, and Kang Zhao, “Phase-variable parallel synchronized triple bias flips (PV-P-S3BF) interface circuit towards broadband piezoelectric energy harvesting,” *Proceedings of the 2017 IEEE International Symposium on Circuits and Systems (in review)*, Florence, Italy, 2018. (ISCAS 2018)
- C26 Junrui Liang*, Shuai Zhang, and Chaoqi Wang, “An improvement on extended impedance method towards efficient design and analysis of high-frequency class-E resonant inverters,” *IPEC-Niigata 2018 - ECCE Asia*, May 20-24 2018, Niigata, Japan. (ECCE Asia 2018)
- C25 Bao Zhao and Junrui Liang*, “On the circuit solutions towards broadband and high-capability piezoelectric energy harvesting systems,” *Proceedings of SPIE Conference 10595, Active and Passive Smart Structures and Integrated Systems*, March 4-8, 2018, Denver, USA. (SPIE SS/NDE 2018)
- C24 Kang Zhao, Junrui Liang*, and Chen Chen, “Synchronized seven bias-flip (S7BF) interface circuit: a new power conditioning solution for piezoelectric energy harvesting enhancement,” *The 43rd Annual Conference of the IEEE Industrial Electronics Society*, October 29 - November 1, 2017, Beijing, China. (IECON 2017)
- C23 Junrui Liang* and Chenbin Zhou, “使用双参数可调同步开关功率调理电路提升压电俘能器发电效能，拓展发电频宽 (Enhancing the piezoelectric energy harvesting capability and broadening the harvesting bandwidth by using a dual-parameter tunable synchronized switch power conditioning circuit),” 中国力学大会 (*The Chinese Congress on Theoretical and Applied Mechanics*), Beijing, China, August 13-16, 2017.
- C22 Junrui Liang* and Shuai Zhang, “An efficient steady-state simulation of class-e resonant inverter considering MOSFET parasitic components by using extended impedance method,” *International Future Energy Electronics Conference 2017 – ECCE Asia*, Kaohsiung, Taiwan, 2017. (ECCE Asia 2017)
- C21 Kang Zhao, Yuheng Zhao, and Junrui Liang*, “Live Demonstration of A vibration-powered Bluetooth wireless sensor node with running PFC power conditioning,” *Proceedings of the 2017 IEEE International Symposium on Circuits and Systems*, Baltimore, USA, 2017. (ISCAS 2017)
- C20 Kang Zhao, Yuheng Zhao, and Junrui Liang*, “A vibration-powered Bluetooth wireless sensor node with running PFC power conditioning,” *Proceedings of the 2017 IEEE International Symposium on Circuits and Systems*, Baltimore, USA, 2017. (ISCAS 2017)
- C19 Chen Chen and Junrui Liang*, "Impedance analysis of piezoelectric energy harvesting system using synchronized charge extraction interface circuit," *Proceedings of SPIE Conference 10164, Active and Passive Smart Structures and Integrated Systems*, Portland, USA, 2017. (SPIE SS/NDE 2017)
- C18 Junrui Liang* and Yi-Chung Shu, "Impedance modeling of electromagnetic energy harvesting system using full-wave bridge rectifier," *Proceedings of SPIE Conference 10164, Active and Passive Smart Structures and Integrated Systems*, Portland, USA, 2017. (SPIE SS/NDE 2017)
- C17 Yuheng Zhao and Junrui Liang*, "Parallel synchronized triple bias-flip circuit for piezoelectric energy harvesting enhancement: operation principle and experimental

validation," *Proceedings of the IEEE Energy Conversion Congress & Expo*, Milwaukee, USA, 2016. (ECCE 2016)

- C16 Junrui Liang*, "Design of class-E power amplifier with nonlinear components by using extended impedance method," *Proceedings of the 2016 IEEE International Symposium on Circuits and Systems*, pp. 437-440, Montreal, Canada, 2016. (ISCAS 2016)
- C15 Haili Liu, Cong Ge, Junrui Liang*, "A comparative study on the self-powered mechatronic and electronic synchronized switch interfaces for piezoelectric energy harvesting systems," *Proc. SPIE Conference 9799, Active and Passive Smart Structures and Integrated Systems 2016*, 97991Q, Las Vegas, USA, 2016. (SPIE SS/NDE 2016)
- C14 Yuheng Zhao, Chenbin Zhou, and Junrui Liang*, "Implementation of synchronized triple bias-flip interface circuit towards higher piezoelectric energy harvesting capability," *Proceedings of the 26th International Conference on Adaptive Structures and Technologies*, Kobe, Japan, 2015. (ICAST 2015)
- C13 Haili Liu, Cong Ge, Junrui Liang*, "A mechanical solution of self-powered SSHI interface for piezoelectric energy harvesting systems," *Proc. SPIE Conference 9431, Active and Passive Smart Structures and Integrated Systems 2015*, 94310E, San Diego, USA. (SPIE SS/NDE 2015)
- C12 Liya Zhao, Junrui Liang, Lihua Tang*, Yaowen Yang, and Haili Liu, "Enhancement of galloping-based wind energy harvesting by synchronized switching interface circuits," *Proc. SPIE Conference 9431, Active and Passive Smart Structures and Integrated Systems 2015*, 94311G, San Diego, USA. (SPIE SS/NDE 2015)
- C11 Haili Liu and Junrui Liang*, "Design of a class-E inverter for piezoelectric ultrasound generation against load variation," *Proceedings of 2014 Symposium on Piezoelectricity, Acoustic Waves, and Device Applications*, pp. 118-121, Beijing, China, 2014. (SPAWDA 2014)
- C10 Junrui Liang*, "Synchronized triple bias-flips harvesting circuit: a new solution for piezoelectric energy harvesting enhancement," *Proceedings of the 25th International Conference on Adaptive Structures and Technologies*, The Hague, The Netherland, 2014. (ICAST 2014)
- C09 Junrui Liang*, Shuo Shi, and Wei-Hsin Liao, "On the counteractive effect of dielectric loss in piezoelectric energy harvesting," *Proc. SPIE Conference 9057, Active and Passive Smart Structures and Integrated Systems 2014*, 90571F, San Diego, USA. (SPIE SS/NDE 2014)
- C08 Junrui Liang* and Henry Shu-Hung Chung, "Best voltage bias-flipping strategy towards maximum piezoelectric power generation," *Journal of Physics: Conference Series*, vol. 476, p. 012025, London, UK, 2013. (PowerMEMS 2013)
- C07 Junrui Liang and Wei-Hsin Liao*, "Impedance analysis for piezoelectric energy harvesting devices under displacement and force excitations," *Proceedings of 2010 IEEE International Conference on Information and Automation*, pp. 42-47, Harbin, China, 2010. (ICIA 2010) (*Best Information Paper Award*)
- C06 Junrui Liang and Wei-Hsin Liao*, "Impedance matching for improving piezoelectric energy harvesting systems," *Proc. SPIE Conference 7643, Active and Passive Smart Structures and Integrated Systems 2010*, 76430K, San Diego, USA, (SPIE SS/NDE 2010) (**One of the most frequently downloaded papers from the SPIE Digital Library, as of 9 Sep. 2010**)
- C05 Junrui Liang and Wei-Hsin Liao*, "On the influence of dielectric loss in piezoelectric energy harvesting with SSHI interface," *Proceedings of the 20th International Conference on Adaptive Structures and Technologies*, pp. 872-883, Hong Kong, 2009. (ICAST 2009)
- C04 Junrui Liang and Wei-Hsin Liao*, "An improved self-powered switching interface for piezoelectric energy harvesting," *Proceedings of 2009 IEEE International Conference on*

Information and Automation, pp. 945–950, Zhuhai/Macau, China, 2009. (ICIA 2009)
(Best Paper Award in Automation)

- C03 Junrui Liang* and Wei-Hsin Liao, “Simulation and optimization of class-E power amplifiers with extended impedance method,” *Proceedings of 2009 IEEE International Symposium on Circuits and Systems*, pp. 2493–2496, Taipei, Taiwan, 2009. (ISCAS 2009)
- C02 Junrui Liang and Wei-Hsin Liao*, “On the energy flow in piezoelectric energy harvesting with SSHI interface,” *Proceedings of the 19th International Conference on Adaptive Structures and Technologies*, 11 pages, Ascona, Switzerland, 2008. (ICAST 2008)
(Best Student Contributions Award)
- C01 Junrui Liang and Wei-Hsin Liao*, “Energy harvesting and dissipation with piezoelectric materials,” *Proceedings of 2008 IEEE International Conference on Information and Automation*, pp. 446–451, Zhangjiajie, China, 2008. (ICIA 2008)

Patents

- P02 Junrui Liang, Haili Liu, Cong Ge, “A mechanical displacement extremes detecting switch and its application in vibration energy harvesting,” China Patent application, No. 2016109388149.
- P01 Junrui Liang, Yuheng Zhao, “Synchronized multiple bias-flip circuit for kinetic energy harvesting,” China Patent Application, No. 201610938812X.

Invited/Seminar Talks

- Seminar talk at Department of Electrical and Electronic Engineering, Southern University of Science and Technology (SUSTech) Aug. 21, 2017
- Invited talk at IEEE 3M-NANO International Conference Aug. 10, 2017
- Seminar talk at Institute of Applied Mechanics, National Taiwan University Jun. 8, 2017
- Seminar talk at College of Electronic Science and Technology, Shenzhen University May 12, 2017
- Seminar talk at School of Mechanical Engineering, Xi’an Jiao Tong University / State Key Laboratory for Manufacturing System Engineering May 3, 2017
- Seminar talk at School of Mechano-Electronic Engineering, Xidian University May 2, 2017
- Seminar talk at Department of Mechanical and Biomedical Engineering, City University of Hong Kong Jan. 23, 2017
- Seminar talk at School of Electronics and Information Technology, Sun Yat-Sen University Jul. 04, 2016
- Seminar talk at University of Michigan - Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University Apr. 25, 2016
- Seminar talk at Department of Electrical Engineering and Computer Science, University of California, Berkeley, CA, USA Dec. 08, 2015
- Seminar talk at Department of Mechanical Engineering, University of Connecticut, CT, USA Nov. 12, 2015
- Seminar talk at Department of Mechanical Engineering, Stony Brook University, NY, USA Nov. 10, 2015

- Seminar talk at School of Instrument Science and Opto-electronics Engineering, Hefei University of Technology Dec. 26, 2014
- Seminar talk at Department of Precision Machinery and Precision Instrumentation, University of Science and Technology of China Dec. 26, 2014
- Seminar talk at Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong Aug. 12 2014
- Seminar talk at Department of Instrument Science and Engineering, Shanghai Jiao Tong University May 23, 2014
- Seminar talk at State key laboratory of mechanics and control of mechanical structures, Nanjing Aeronautics and Astronautics University April 22, 2014
- Open Day Seminar, ShanghaiTech University April 07, 2014
- Seminar Series, School of Information Science and Technology, ShanghaiTech University Mar. 04, 2014

Research Grants

ShanghaiTech University

- *Faculty Start-up Funding*, supporting the research entitled “Hybrid vibration energy harvesting system: holistic modeling and optimization” from 2013/11 to 2016/10, CNY 2,000,000.

National Natural Science Foundation of China

- *Young Scientists Fund* supporting the research entitled “A study on the maximum harvesting capability of piezoelectric energy harvesting circuit, from 2015/01 to 2017/12, CNY 270,000.

Research Team / Student Supervision

Graduate students

2014: Junlong WANG

2015: Kang ZHAO, Chen CHEN

2016: Shuai ZHANG

2017: Bao ZHAO, Shiyong WANG, Hong TANG

2018: Kangfu LIU

Final year project students (undergraduate)

2014: Cong GE

2015: Kang ZHAO (**excellent FYP Award in Tongji University**), Haiqing DONG, Chen CHEN

2017: Hong TANG

2018: Chaoqi WANG, Kangfu LIU, Yiming GAO

Undergraduate mentorship

2014: Keyu YAN, Wentao LV, Junyi FENG, Haizhou FANG, Yichi ZHANG, Jianian LI

2015: Jiatong YU, Yao ZHANG, Yifei XU, Xiangchen ZENG, Jingyi HUANG

2016: Yuzhu JIN, Lu YAO, Xinchen WANG, Haoyu LIU, Ziyuan HU, Minjie SONG, Chengzhang HE

2017: Tianli TAO, Zhiyuan GAO, Zhifeng TANG, Xu CAI, Haochuan WANG, Haoyun CHEN

Alumni

Davide LO CASTRO (Visiting Student 2017, from Polytechnic University of Milan)

Haokun GUO (Visiting Student 2017, from Southeast University, China)

Cong GE (Master Student 2014-2017)

Chenbin ZHOU (Master Student 2014-2017)

Yuheng ZHAO (Master Student 2014-2017)

Dr. Haili Liu (Postdoctoral Fellow 2014-2016)

Mr. Lijun TU (Lab Manager 2015-2016)

School / University Services

Co-chair of school-level committees

Curriculum and Teaching Committee (Apr. 2017 – present)

Member of school-level committees

Academic Affairs Committee (Sept. 2014 – present)

Public Relation Committee (Sept. 2014 – Aug. 2016)

Research Management Committee (Jan. 2016 – present)

Staff Search Committee (Sept. 2016 – Apr. 2017)

Professional Affiliations and Activities

Member of

Institute of Electrical and Electronics Engineers (IEEE)

American Society of Mechanical Engineers (ASME)

China Power Supply Society (CPSS)

Reviewer of

Journals: IEEE Transactions on Circuit and System I: Regular Papers / IEEE Transactions on Industrial Electronics / IEEE Transactions on Power Electronics / Electronics Letters / IEEE/ASME Transactions on Mechatronics / IEEE Transactions on Automation Science and Engineering / IEEE Transactions on Control Systems Technology / IEEE Transactions on Automation Science and Engineering / IEEE Transactions on Industry Applications / IEEE Industry Applications Magazine / IEEE Internet of Things Journal / Applied Physics Letters / Sensors & Actuators: A. Physical / Journal of Intelligent Material Systems and Structures / Smart Materials and Structures / Journal of Micromechanics and Microengineering / Microsystems & Nanoengineering / Journal of Modern Power Systems and Clean Energy / IET Circuits, Devices & Systems / International Journal of Circuit Theory and Applications / Journal of Semiconductors (半导体学报) / Acta Physica Sinica (物理学报) / SCIENCE CHINA Information Sciences (中国科学: 信息科学) / Energy Conversion and Management / International Journal of Smart and Nano Materials / Recent Patents on Electrical & Electronic

Engineering / Sensors (MDPI) / Technologies (MPDI) / Micromachines (MPDI) / Sustainability (MDPI) / Latin American Journal of Solids and Structures

Conferences: IEEE International Symposium on Circuits and Systems (ISCAS) / IEEE Energy Conversion Congress and Exposition (ECCE) / IEEE Energy Conversion Congress and Exposition Asia (ECCE Asia) / Annual Conference of the IEEE Industrial Electronics Society (IECON) / IEEE International Conference on NEW Circuits and Systems (NEWCAS) / IEEE International Conference on Control and Automation (ICCA)

Service in Academic Conferences

Program Committee Member of SPIE Smart Structures/NDE conference since 2016

Special Session Organizer and Review Committee Member in IEEE International Symposium on Circuits and Systems (ISCAS) 2018

Section Chair in IEEE 3M-NANO International Conference 2017

Section Chair in IEEE International Symposium on Circuits and Systems (ISCAS) 2017

Section Chair in SPIE Smart Structures/NDE conference, March 2014, 2015, 2016

Section Chair in International Conference on Adaptive Structures and Technologies (ICAST), October 2015

Technical Committee in Academic Societies

Technical Committee Member of Power and energy circuits and systems (PECAS) in IEEE Circuits and Systems Society since 2016

Technical Committee Member of Energy Harvesting Technical Committee (EHTC) in Adaptive Structures and Material Systems Branch, ASME Aerospace Division since 2016