

Tingjun Chen

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RESEARCH INTERESTS

Internet-of-Things, energy harvesting networks, full-duplex wireless, massive antenna and millimeter-wave systems, optical-wireless and 5G networks: Physical/MAC layer algorithms, optimization, system design and implementation.

EDUCATION

- Ph.D. Electrical Engineering, Columbia University, New York, NY
2014–Present Advisor: Prof. Gil Zussman
M.Phil. received in Feb. 2018, Cumulative GPA: 4.14/4.00
M.S. received in Oct. 2015, Final GPA: 4.13/4.00
- B.Eng. Electronic Engineering, Tsinghua University, Beijing, China
2010–2014 Advisors: Prof. Zhisheng Niu and Prof. Sheng Zhou

HONORS & AWARDS

- 2018 The 6th Heidelberg Laureate Forum Young Researcher
2018 **Columbia Engineering Oscar and Verna Byron Fellowship**
based on academic achievement and clear potential for future success
2018 Creative Tech Award, demo at the NYC Media Lab’s Annual Summit
2018 Columbia EE Millman Award for Outstanding Teaching Assistant
2018 National Instruments Academic Research Grant
2017 Qualcomm Innovation Fellowship Finalist
2017 National Instruments Academic Research Grant
2014–2017 **Wei Family Private Foundation Fellowship**
granted to students of Chinese heritage, only 3 fellowships were awarded in 2014–2017
2016 **ACM CoNEXT Best Paper Award**
2016 Honorable Mention Award, demo at the NYC Media Lab’s Annual Summit
2015 **Columbia EE Edwin Howard Armstrong Memorial Award**
awarded to one outstanding M.S. candidate, highest recognition awarded to an M.S. student
2014 Tsinghua University Outstanding Undergraduate Thesis Award
2014 Tsinghua Scholarship for Academic Advancement
2014 Tsinghua Scholarship for Literature and Art Excellence

PUBLICATIONS

- Conference Proceedings** Acceptance Ratios (AR) in parentheses
- [c.11] **T. Chen**, M. Baraani Dastjerdi, J. Zhou, H. Krishnaswamy, and G. Zussman, “Wideband Full-Duplex Wireless via Frequency-Domain Equalization: Design and Experimentation,” in *Proc. ACM MobiCom’19 (to appear)*, 2019 (AR: 24.0%).
- [c.10] **T. Chen**, J. Diakonikolas, J. Ghaderi, and G. Zussman, “Fairness and Delay in Heterogeneous Half- and Full-Duplex Wireless Networks,” in *Proc. Asilomar Conference on Signals, Systems, and Computers (invited) (to appear)*, 2018.
- [c.9] **T. Chen**, J. Diakonikolas, J. Ghaderi, and G. Zussman, “Hybrid Scheduling in Heterogeneous Half- and Full-Duplex Wireless Networks,” in *Proc. IEEE INFOCOM’18*, 2018 (AR: 19.1%).
- [c.8] M. Baraani Dastjerdi, N. Reiskarimian, **T. Chen**, G. Zussman, and H. Krishnaswamy, “Full Duplex Circulator-Receiver Phased Array Employing Self-Interference Cancellation via Beamforming,” in *Proc. IEEE RFIC Symposium*, 2018.

- [c.7] M. Baraani Dastjerdi, **T. Chen**, N. Reiskarimian, G. Zussman, and H. Krishnaswamy, “Self-Interference Cancellation via Beamforming in an Integrated Full Duplex Circulator-Receiver Phased Array,” in *Proc. IEEE SPCOM’18 (invited)*, 2018.
- [c.6] **T. Chen**, J. Ghaderi, D. Rubenstein, and G. Zussman, “Performance Evaluation of Energy-Constrained Broadcast (EconCast) in Wireless Networks,” in *Proc. IEEE WCNC’17 Workshop on Energy Harvesting and Remotely Powered Wireless Communications for the IoT (invited)*, 2017.
- [c.5] **T. Chen**, J. Ghaderi, D. Rubenstein, and G. Zussman, “Maximizing Broadcast Throughput Under Ultra-Low-Power Constraints,” in *Proc. ACM CoNEXT’16*, 2016 (AR: 17.6%).
Best Paper Award
- [c.4] H. Krishnaswamy, G. Zussman, J. Zhou, J. Marasevic, T. Dinc, N. Reiskarimian, and **T. Chen**, “Full-Duplex in a Hand-held Device - From Fundamental Physics to Complex Integrated Circuits, Systems and Networks: An Overview of the Columbia FlexICoN project,” in *Proc. Asilomar Conference on Signals, Systems, and Computers (invited)*, 2016.
- [c.3] J. Marasevic, **T. Chen**, J. Zhou, N. Reiskarimian, H. Krishnaswamy, and G. Zussman, “Full-Duplex Wireless: Algorithms and Rate Improvement Bounds for Integrated Circuit Implementations,” in *Proc. ACM HotWireless’16 (invited)*, 2016.
- [c.2] R. Margolies, G. Grebla, **T. Chen**, D. Rubenstein, and G. Zussman, “Panda: Neighbor Discovery on a Power Harvesting Budget,” in *Proc. IEEE INFOCOM’16*, 2016 (AR: 18.3%).
- [c.1] **T. Chen**, S. Zhou, W. Chen, and Z. Niu, “Power Control Policies for a Wireless Link with Energy Harvesting Transmitter and Receiver,” in *Proc. IEEE WiOpt’14*, 2014 (AR: 28.7%).

Journal Articles

- [j.5] N. Reiskarimian, T. Dinc, J. Zhou, **T. Chen**, M. Baraani Dastjerdi, J. Diakonikolas, G. Zussman, and H. Krishnaswamy, “A One-Way Ramp to a Two-Way Highway: Integrated Magnetic-Free Non-Reciprocal Antenna Interfaces for Full Duplex Wireless,” *IEEE Microwave Magazine (invited) (to appear)*, 2019.
- [j.4] **T. Chen**, J. Ghaderi, D. Rubenstein, and G. Zussman, “Maximizing Broadcast Throughput Under Ultra-Low-Power Constraints,” *IEEE/ACM Transactions on Networking*, vol. 26, no. 2, pp. 779-792, Apr. 2018.
- [j.3] J. Zhou, N. Reiskarimian, J. Marasevic, T. Dinc, **T. Chen**, G. Zussman, and H. Krishnaswamy, “Integrated Full Duplex Radios,” *IEEE Communications Magazine (invited)*, vol. 55, no. 4, pp. 142-151, Apr. 2017.
- [j.2] R. Margolies, G. Grebla, **T. Chen**, D. Rubenstein, and G. Zussman, “Panda: Neighbor Discovery on a Power Harvesting Budget,” *IEEE Journal on Selected Areas in Communications, Series on Green Communications and Networking*, vol. 34, no. 12, pp. 3606-3619, Dec. 2016.
- [j.1] S. Zhou, **T. Chen**, W. Chen, and Z. Niu, “Outage Minimization for a Fading Wireless Link with Energy Harvesting Transmitter and Receiver,” *IEEE Journal on Selected Areas in Communications, Special Issue on Wireless Communications Powered by Energy Harvesting and Wireless Energy Transfer*, vol. 33, no. 3, pp. 496-511, Mar. 2015.

Demonstrations (Peer Reviewed)

- [d.4] **T. Chen**, M. Baraani Dastjerdi, G. Farkash, J. Zhou, H. Krishnaswamy, and G. Zussman, “Demo Abstract: Open-Access Full-Duplex Wireless in the ORBIT Testbed,” in *Proc. IEEE INFOCOM’18*, Honolulu, HI, Apr. 2018.
- [d.3] **T. Chen**, J. Zhou, M. Baraani Dastjerdi, J. Diakonikolas, H. Krishnaswamy, and G. Zussman, “Demo Abstract: Full-Duplex with a Compact Frequency Domain Equalization-based RF Canceller,” in *Proc. IEEE INFOCOM’17*, Atlanta, GA, May 2017.
- [d.2] **T. Chen**, G. Chen, S. Jain, R. Margolies, G. Grebla, D. Rubenstein, and G. Zussman, “Demo Abstract: Power-Aware Neighbor Discovery for Energy Harvesting Things,” in *Proc. ACM SenSys’16*, Stanford, CA, Nov. 2016.
- [d.1] **T. Chen**, J. Zhou, N. Grimwood, R. Fogel, J. Marasevic, H. Krishnaswamy, and G. Zussman, “Demo: Full-Duplex Wireless based on a Small-Form-Factor Analog Self-Interference Canceller,” in *Proc. ACM MobiHoc’16*, Paderborn, Germany, July 2016.

Technical Reports

- [tr.5] **T. Chen**, M. Baraani Dastjerdi, J. Zhou, H. Krishnaswamy, and G. Zussman, "Open-Access Full-Duplex Wireless in the ORBIT Testbed," *arXiv preprint*: 1801.03069v2 [cs.NI], May 2018.
- [tr.4] **T. Chen**, J. Diakonikolas, J. Ghaderi, and G. Zussman, "Hybrid Scheduling in Heterogeneous Half- and Full-Duplex Wireless Networks," *arXiv preprint*: 1801.01108 [cs.NI], Jan. 2018.
- [tr.3] **T. Chen**, J. Ghaderi, D. Rubenstein, and G. Zussman, "Maximizing Broadcast Throughput Under Ultra-Low-Power Constraints," *arXiv preprint*: 1610.04203v2 [cs.NI], Apr. 2017.
- [tr.2] R. Margolies, G. Grebla, **T. Chen**, D. Rubenstein, and G. Zussman, "Panda: Neighbor Discovery on a Power Harvesting Budget," *arXiv preprint*: 1601.06474 [cs.NI], Jan. 2016.
- [tr.1] S. Zhou, **T. Chen**, W. Chen, and Z. Niu, "Outage Minimization for a Fading Wireless Link with Energy Harvesting Transmitter and Receiver," *arXiv preprint*: 1503.04255 [cs.IT], Mar. 2015.

Patents

- [p.4] D. Rubenstein, G. Zussman, J. Ghaderi, R. Margolies, **T. Chen**, G. Grebla, "Systems and Methods for Throughput Enhancement Among Ultra-Low power Wireless Network Devices," *U.S. Patent Application* No.15/211,740, filed July 2016.
- [p.3] D. Rubenstein, G. Zussman, J. Ghaderi, **T. Chen**, "Systems and Methods for Asynchronous Discovery and Throughput Maximization Among Ultra-Low Power Wireless Networked Devices," *U.S. Provisional Patent* No.62/288,330, filed Jan. 2016.
- [p.2] D. Rubenstein, G. Zussman, R. Margolies, **T. Chen**, G. Grebla, "Systems and Methods for Asynchronous Discovery Among Ultra-Low Power Wireless Devices," *U.S. Provisional Patent* No.62/217,624, filed Sept. 2015.
- [p.1] D. Rubenstein, G. Zussman, R. Margolies, **T. Chen**, G. Grebla, "Systems and Methods for Asynchronous Discovery Among Ultra-Low Power Wireless Devices," *U.S. Provisional Patent* No.62/193,501, filed July 2015.

ACADEMIC EXPERIENCE

2014–Present **Wireless & Mobile Networking (WiMNet) Lab**, Columbia University

- Develop PHY layer and MAC layer algorithms for full-duplex networks based on Radio Frequency Integrated Circuit (RFIC) implementation. Design an experimental testbed composed of both single- and multi-antenna full-duplex radio prototypes based on USRP software-defined radios. Lead a team of M.S. and undergraduate students to fabricate a custom-designed full-duplex testbed. Gen-1 full-duplex prototype is integrated with the **ORBIT testbed** and is the *world's first remotely-accessible full-duplex node* that allows research in this area. This work is within the **Full-Duplex Wireless: From Integrated Circuits to Networks (FlexICoN)** project and in collaboration with Prof. Harish Krishnaswamy's group. The design of MAC layer algorithms is in also collaboration with Prof. Javad Ghaderi.
- Develop and analyze centralized and distributed algorithms for neighbor discovery and broadcast throughput maximization in ultra-low-power networks, in which devices are powered by energy harvesting. Applications include object tracking and monitoring, manufacturing, and Internet-of-Things (IoT). Implement and evaluate algorithms using a testbed composed of light energy harvesting transceivers. This work is within the **Energy Harvesting Active Networked Tags (EnHANTs)** project and in collaboration with Prof. Dan Rubenstein and Prof. Javad Ghaderi.
- Develop and implement an optical-wireless testbed that integrates software defined radios with customizable radio edge-cloud networks using real dark fiber through Manhattan for C-RAN applications. Testbed utilizes optical switching controlled by the software defined networking (SDN) control plane to send radio signals through multi-hop dark fiber network for real-time remote processing. Develop efficient algorithms across various layers of the network stack to optimize the system performance. This work is within the **Cloud Enhanced Open Software Defined MOBILE Wireless Testbed for City-Scale Deployment (COSMOS)** project and in collaboration with Prof. Dan Kilper's group at the U. of Arizona.

2012–2014 **Network Integration for Ubiquitous Linkage and Broadband (NiuLab)**, Tsinghua University

- Designed and analyzed optimal power control policies which minimize the outage probability for a wireless communication link with energy harvesting transmitter and receiver.

- Summer 2013 **Wireless & Mobile Networking (WiMNet) Lab**, Columbia University
- Developed MSP430 microcontroller-based prototype for the **Energy Harvesting Active Networked Tags (EnHANTs)** project. Implemented serial data forwarding method and data transmission method on an ARM architecture-based Raspberry Pi gateway.

INTERNSHIP EXPERIENCE

- Summer 2018 **Wireless Access Lab**, Nokia Bell Labs, Crawford Hill, NJ
 Research Intern. Mentors: Jinfeng Du, Dmitry Chizhik, Reinaldo Valenzuela
 Measurements, modeling, and performance analysis of 28GHz millimeter-wave networks in dense urban canyon environments.

MENTORING AND ADVISING

- Master Students Siao-Ting Wang (Fall 2018–Present)
 Guy Farkash (Fall 2017–Present, **EE Dept. M.S. Honors Student**)
 Steven Alfano (Fall 2016–Fall 2017, now at Wolverine Trading) – **EE Dept. M.S. Research Award**
 Rel Fogel (Fall 2015–Spring 2016, now at Front Gate Tickets)
 Rama Kompella (Spring 2015)
- Undergraduate Students Kimberly Santiago (Fall 2018–Present)
 Jenny Li (Fall 2017–Present)
 Gregory Chen (Spring 2016, now at Bloomberg LP)
 Saahil Jain (Fall 2015–Spring 2016, now at Microsoft)
 Nicole Grimwood (Fall 2015–Spring 2016, Stanford EE M.S., now at Cohere Technologies) – **EE Dept. Undergraduate Research Award**
 James Thompson (Fall 2015–Spring 2016, now at Lockheed Martin)
- Visiting Students Fan Yi (Summer 2017, Shanghai Jiao Tong University, China)
 Jinhui Song (Summer 2017, Tsinghua University, China, now a Ph.D. student at UIUC ECE)
 Aishwarya Rajen (Summer 2017, Anna University, India)
 Alexandre Simoes (Summer 2015, Universidade de Sao Paulo, Brazil)

PROFESSIONAL ACTIVITIES

- Program ACM MobiCom S³ Workshop 2016
 Committee
- Journal Reviews IEEE/ACM Transactions on Networking (TON) 2018
 IEEE Transactions on Communications (TCOM) 2018
 IEEE Communications Magazine 2017
 IEEE Communications Letters 2017
 IEEE Microwave Magazine 2017
 Elsevier Physical Communication 2017
 ACM Transactions on Embedded Computing Systems (TECS) 2016
 ACM Transactions on Sensor Networks (TOSN) 2015
- Conference ACM MobiCom 2018, 2016
 Reviews ACM MobiHoc 2018, 2017, 2016, 2015
 ACM SIGMETRICS 2019, 2018, 2017, 2016, 2015
 IFIP WD 2016
 IEEE ICC 2016, 2015
- Volunteer IFIP Performance 2017, New York, NY
 ACM MobiCom 2016, New York, NY
 ACM MobiHoc 2015 TPC Meeting, New York, NY
 IEEE ICC 2012, Beijing, China
- Outreach Demo and poster at the Silicon Harlem's 5th Annual Conference, Oct. 2018
 Science Expo at The School at Columbia University, Apr. 2018
 High school outreach at the Manhattan Center for Science and Mathematics, Oct. 2015

TALKS, DEMOS, AND ADDITIONAL PRESENTATIONS

- Asilomar* “Fairness and Delay in Heterogeneous Half- and Full-Duplex Wireless Networks,” Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, Oct. 2018. (talk)
- Silicon Harlem* “Open-Access Full-Duplex Wireless in the ORBIT Testbed,” Silicon Harlem’s 5th Annual Conference, New York, NY, Oct. 2018. (demo)
- HLF* “Maximizing Broadcast Throughput under Ultra-Low-Power Constraints,” 6th Heidelberg Laureate Forum, Heidelberg, Germany, Sept. 2018. (poster-flash and poster)
- TU Munich* “Maximizing Broadcast Throughput under Ultra-Low-Power Constraints,” Department of Electrical and Computer Engineering, Technical University of Munich, Munich, Germany, Sept. 2018. (**invited talk**)
- NYC Media Lab* “Open-Access Full-Duplex Wireless in the ORBIT Testbed,” NYC Media Lab’s Annual Summit, The New School, New York, NY, Sept. 2018. (demo) **Creative Tech Award in Engineering**
- Tsinghua U.* “Maximizing Broadcast Throughput under Ultra-Low-Power Constraints,” Institute of Interdisciplinary Information Sciences (IIIS), Tsinghua University, Beijing, China, Aug. 2018. (**invited talk**)
- Tsinghua U.* “Full-Duplex Wireless in Hand-Held Devices: From Circuits to Networks,” Department of Electronic Engineering, Tsinghua University, Beijing, China, Aug. 2018. (**invited talk**)
- Nokia Bell Labs* “The COSMOS Wireless Testbed and Experimentation with Compact Full Duplex Wireless,” Nokia Bell Labs, Crawford Hill, NJ, July 2018. (**invited talk**)
- IEEE RFIC* “Fully-Integrated Non-Magnetic 180nm SOI Circulator,” IEEE RFIC Symposium, Philadelphia, PA, June 2018. (demo)
- IEEE INFOCOM* “Hybrid Scheduling in Heterogeneous Half- and Full-duplex Wireless Networks,” IEEE INFOCOM, Honolulu, HI, Apr. 2018. (talk)
- NYU* “Open-Access Full-Duplex Wireless in the ORBIT Testbed,” CATT Annual Research Review, NYU, Brooklyn, NY, Apr. 2018. (**invited demo and poster**)
- Columbia DSD* “Open-Access Full-Duplex Wireless in the ORBIT Testbed,” Columbia Data Science Day, Columbia University, New York, NY, Mar. 2018. (demo)
- NI Week* “Full-Duplex Wireless: A Two-Way Road to 5G,” National Instruments NIWeek Academic Forum, Austin, TX, May 2017. (poster)
- QInF* “Full-Duplex MIMO Wireless: From IC Design to Networking,” Qualcomm Innovation Fellowship Final’s Day, San Diego, CA, Apr. 2017. (talk and poster)
- Columbia DSD* “Full-Duplex Wireless: A Two-Way Road to 5G,” Columbia Data Science Day, Columbia University, New York, NY, Apr. 2017. (demo)
- IEEE WCNC-WS* “Performance Evaluation of Energy-Constrained Broadcast (EconCast) in Wireless Networks,” IEEE WCNC Workshop on Energy Harvesting and Remotely Powered Wireless Communications for the IoT, San Francisco, CA, Mar. 2017. (**invited paper**)
- Rutgers U.* “Full-duplex Wireless: Algorithms, Rate Improvement Bounds, and System Implementations,” WINLAB Workshop on Advanced Wireless Experimentation, Rutgers University, North Brunswick, NJ, Mar. 2017 (**invited talk**)
- ACM CoNEXT* “Maximizing Broadcast Throughput under Ultra-Low-Power Constraints,” ACM CoNEXT, Irvine, CA, Dec. 2016. (talk)
- NYC Media Lab* “Double-Talk: Full-Duplex Wireless for Next-Generation Communications,” NYC Media Lab’s Annual Summit, Columbia University, New York, NY, Sept. 2016. (demo) **Honorable Mention Award**
- Columbia DSD* “A Self-Interference-Cancelling Full-Duplex Enabling Next-Generation Wireless Communications,” Columbia Data Science Day, Columbia University, New York, NY, Apr. 2016. (demo)
- IEEE WiOpt* “Power Control Policies for a Wireless Link with Energy Harvesting Transmitter and Receiver,” IEEE WiOpt, Hammamet, Tunisia, May 2014. (talk)

TEACHING EXPERIENCE

Columbia University, New York, NY

Summer 2018 Computer Networks (CSEE S4119)

Spring 2018 Large Data Stream Processing (ELEN E6889)
 Fall 2017 Wireless & Mobile Networking I (ELEN E6950)
 Summer 2017 Computer Networks (CSEE S4119)
 Spring 2017 Computer Networks (CSEE S4119)
 Fall 2016 Wireless & Mobile Networking I (ELEN E6950)
 Spring 2016 Wireless & Mobile Networking II (ELEN E6951)
 Spring 2015 Wireless Communications (ELEN E4703)

TECHNICAL SKILLS

Programming Skills C/C++, Python, Java, Visual Basic, HTML, Verilog HDL, nesC, Shell Script, Eclipse, Visual C++, Visual Studio, XCode
 Applications MATLAB, Xilinx, L^AT_EX, Emacs, Vim, GNU Radio, UHD, NI LabVIEW, Linux Wireless, Multisim, Modelsim, Spice/PSpice, Visio, IAR Embedded Workbench, Atmel Studio, AutoCAD
 OS Microsoft Windows, Linux (Ubuntu), Apple Mac OS X
 Databases SQL

SELECTED COURSES

Columbia University, New York, NY

Fall 2017 Topics in Computer Science: Video Over the Internet (COMS E6998)
 Spring 2017 Discrete Optimization (IEOR E8100)
 Spring 2016 Convex Optimization (EEOR E6616)
 Spring 2016 Learning and Optimization for Sequential Decision Making (IEOR E8100)
 Fall 2015 Graph Models: Inference and Optimization (IEOR E8100)
 Fall 2015 Topics in Computer Science: Networks Tags (COMS E6998)
 Spring 2015 Analysis of Algorithm II (COMS E6232)
 Spring 2015 Network Algorithms and Dynamics (ELEN E6909)
 Spring 2015 Optimization II (IEOR E6614)
 Fall 2014 Wireless and Mobile Networking I (ELEN E6950)
 Fall 2014 Analysis of Algorithms I (CSOR W4231)
 Fall 2014 Introduction to Deterministic Models (IEOR E4004)
 Fall 2014 Computer Communication Networks (ELEN E6761)

Tsinghua University, Beijing, China

Spring 2014 Stochastic Network Optimization Theory (Graduate, Rank 1st)
 Spring 2014 Diploma Projects (Bachelor Thesis, Rank 1st)