

TINGJUN CHEN

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RESEARCH INTERESTS

Internet-of-Things, ultra-low-power and 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

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

HONORS & AWARDS

- 2019 **Facebook Fellowship**
in Networking and Connectivity, only 21 fellows were selected out of more than 900 applications worldwide
- 2018 The 6th Heidelberg Laureate Forum Young Researcher
only 200 young researchers were selected worldwide, recipient of the SkyLabs grant
- 2018 Columbia Engineering Oscar and Verna Byron Fellowship
selected 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 Jacob Millman Award (Outstanding Teaching Assistant)
- 2017, 2018 National Instruments Academic Research Grant (twice)
- 2017 Qualcomm Innovation Fellowship Finalist
- 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

- C12. **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, **acceptance rate 24.0% (25/104)**.
- C11. **T. Chen**, M. Baraani Dastjerdi, H. Krishnaswamy, and G. Zussman, "Wideband Full-Duplex Phased Array with Joint Transmit and Receive Beamforming: Optimization and Rate Gains," in *Proc. ACM MobiHoc'19 (to appear)*, 2019, **acceptance rate 23.7% (37/156)**.
- C10. J. Yu, **T. Chen**, C. Gutterman, S. Zhu, G. Zussman, I. Seskar, and D. Kilper, "COSMOS: Optical Architecture and Prototyping," in *Proc. OSA OFC'19, M3G.3 (invited)*, 2019.
- C9. A. Nagulu, **T. Chen**, G. Zussman, and H. Krishnaswamy, "A Full-Duplex Radio Using a CMOS Integrable Circulator Achieving +95 dB Overall SIC," in *Proc. IEEE APS-URSI'19 (invited) (to appear)*, 2019.

- C8. **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)*, 2018.
- C7. **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, **acceptance rate 19.2% (308/1,606)**.
- C6. 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.
- C5. 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.
- C4. **T. Chen**, J. Ghaderi, D. Rubenstein, and G. Zussman, "Maximizing Broadcast Throughput Under Ultra-Low-Power Constraints," in *Proc. ACM CoNEXT'16*, 2016, **acceptance rate 17.6% (35/199)**.
- Best Paper Award**
- C3. 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.
- C2. 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, **acceptance rate 18.3% (300/1,644)**.
- C1. **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, **acceptance rate 28.7% (48/167)**.

Journals

- J6. **T. Chen**, J. Diakonikolas, J. Ghaderi, and G. Zussman, "Hybrid Scheduling in Heterogeneous Half- and Full-Duplex Wireless Networks," *submitted*, 2019.
- J5. 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)*, vol. 20, no. 2, pp. 56-75, Feb. 2019.
- J4. **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.
- J3. 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.
- J2. 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.
- J1. 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.

Patents

- Pa1. 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 US 10,200,956 B2, Feb. 2019.

Workshops

- W3. A. Nagulu, **T. Chen**, G. Zussman, and H. Krishnaswamy, "A Single Antenna Full-Duplex Radio Using a Non-Magnetic, CMOS Circulator with In-built Isolation Tuning," in *Proc. IEEE ICC'19 Workshop on Full-Duplex Communications for Future Wireless Networks (invited) (to appear)*, 2019.
- W2. **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.

- W1. 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.

Demonstrations (Peer Reviewed)

- D4. **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.
- D3. **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.
- D2. **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.
- D1. **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

- Tr6. **T. Chen**, M. Baraani Dastjerdi, J. Zhou, H. Krishnaswamy, and G. Zussman, “Wideband Full-Duplex Wireless via Frequency-Domain Equalization: Design and Experimentation,” *arXiv preprint*: 1812.01126 [eess.SP], Dec. 2018.
- Tr5. **T. Chen**, J. Diakonikolas, J. Ghaderi, and G. Zussman, “Hybrid Scheduling in Heterogeneous Half- and Full-Duplex Wireless Networks,” *arXiv preprint*: 1801.01108v2 [cs.NI], Nov. 2018.
- Tr4. **T. Chen**, M. Baraani Dastjerdi, G. Farkash, J. Zhou, H. Krishnaswamy, and G. Zussman, “Open-Access Full-Duplex Wireless in the ORBIT Testbed,” *arXiv preprint*: 1801.03069v2 [cs.NI], May 2018.
- Tr3. **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.
- Tr2. 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.
- Tr1. 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.

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 wireless testbed composed of customized full-duplex radios. 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 collaboration with Prof. Javad Ghaderi.
- Developed and analyzed 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). Implemented and evaluated 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 NYC dark fiber for C-RAN applications. The 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 University 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 **E**nergy **H**arvesting **A**ctive **N**etworked **T**ags (**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 Shanglin Guo (Spring 2019–Present)

Guanxuan Li (Spring 2019–Present)

Shounak Roy (Spring 2019–Present)

Siao-Ting Wang (Fall 2018–Spring 2019, currently at Amazon)

Guy Farkash (Fall 2017–Fall 2018, currently at Knaq) – **EE Dept. M.S. Honors Student**

Steven Alfano (Fall 2016–Fall 2017, currently at Wolverine Trading) – **EE Dept. M.S. Research Award**

Rel Fogel (Fall 2015–Spring 2016, currently at Front Gate Tickets)

Rama Kompella (Spring 2015)

Undergraduate Angel Daniel Estigarribia (Spring 2019–Present)

Students Jason Dai (Spring 2019–Present)

Kimberly Santiago (Fall 2018–Present)

Jackson Welles (Spring 2018–Present) – **EE Dept. Undergraduate Research Award**

Jenny Li (Fall 2017–Present)

Gregory Chen (Spring 2016, currently at Bloomberg LP)

Nicole Grimwood (Fall 2015–Spring 2016, Stanford EE M.S., currently at Cohere Technologies) – **EE Dept.**

Undergraduate Research Award

Saahil Jain (Fall 2015–Spring 2016, currently at Microsoft)

James Thompson (Fall 2015–Spring 2016, currently at Lockheed Martin)

Visiting Students Fan Yi (Summer 2017, Shanghai Jiao Tong University, China, to start Ph.D. at Princeton CS)

Jinhui Song (Summer 2017, Tsinghua University, China, currently a Ph.D. student at UIUC ECE)

Aishwarya Rajen (Summer 2017, Anna University, India)

Alexandre Simoes (Summer 2015, Universidade de Sao Paulo, Brazil)

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)

PROFESSIONAL ACTIVITIES

Organizing Committee Local Arrangements Chair, ACM SenSys 2019

Technical Program Committee IEEE Future Networking Workshop for 5G and Beyond Testbed and Trials 2019
ACM MobiCom S³ Workshop 2016

Journal Reviewer IEEE/ACM Transactions on Networking (TON) 2019, 2018
IEEE Transactions on Communications (TCOM) 2018
IEEE Communications Magazine 2018, 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 Reviewer ACM MobiCom 2018, 2016
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

(In addition to conference and workshop presentations)

UC Riverside "The COSMOS Wireless Testbed and Experimentation with Compact Full-Duplex Wireless," Department of Computer Science and Engineering, University of California at Riverside, Riverside, CA, Apr. 2019. (CSE seminar)

Columbia DSD'19 "Real-Time Full-Duplex Wireless using an Integrated CMOS Circulator," Columbia Data Science Day, Columbia University, New York, NY, Apr. 2019. (demo)

DARPA MTO RF Showcase "Fully-Integrated Non-Magnetic 180nm SOI Circulator," DARPA MTO RF Showcase, Johns Hopkins University Applied Physics Lab, Laurel, MD, Dec. 2018. (demo)

Silicon Harlem "Open-Access Full-Duplex Wireless in the ORBIT Testbed," Silicon Harlem's 5th Annual Conference, New York, NY, Oct. 2018. (demo)

6th 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 (IIS), 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’18* “Fully-Integrated Non-Magnetic 180nm SOI Circulator,” IEEE RFIC Symposium, Philadelphia, PA, June 2018. (demo)
- 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’18* “Open-Access Full-Duplex Wireless in the ORBIT Testbed,” Columbia Data Science Day, Columbia University, New York, NY, Mar. 2018. (demo)
- NI Week’17* “Full-Duplex Wireless: A Two-Way Road to 5G,” National Instruments NIWeek Academic Forum, Austin, TX, May 2017. (poster)
- QInF’17* “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)
- 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)**
- 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’16* “A Self-Interference-Cancelling Full-Duplex Enabling Next-Generation Wireless Communications,” Columbia Data Science Day, Columbia University, New York, NY, Apr. 2016. (demo)

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

Analysis of Algorithms I & II, Computer Communication Networks, Convex Optimization, Optimization, Introduction to Deterministic Models, Discrete Optimization, Wireless and Mobile Networking I, Optimization II, Learning and Optimization for Sequential Decision Making, Graph Models: Inference and Optimization.

Tsinghua University, Beijing, China

Stochastic Network Optimization Theory (Graduate-level, Rank 1st), Diploma Projects (Bachelor Thesis, Rank 1st).