

Tim Woodford

Curriculum Vitae

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Education

- 2020–2023 **Ph.D.**, *University of California, San Diego.*
Wireless Networking and Sensing Systems
- 2018–2020 **Masters of Science**, *University of California, San Diego, GPA – 3.68.*
Wireless Networking and Sensing Systems
- 2014–2018 **Bachelor of Electrical Engineering**, *Bucknell University, Lewisburg, PA.*
GPA – 3.94

Publications

- **Timothy Woodford**, Kun Qian, and Xinyu Zhang. “Metasight: High-Resolution NLoS Radar Sensing through Efficient Metasurface Encoding.” ACM Sensys 2023.
- Kai Zheng, Kun Qian, **Timothy Woodford**, Xinyu Zhang. “NeuroRadar: A Neuromorphic Radar Sensor for Low-Power IoT Systems.” ACM Sensys 2023. (Best paper award.)
- **Timothy Woodford**, Xinyu Zhang, Eugene Chai, and Karthikeyan Sundaresan. “Mosaic: Leveraging Diverse Reflector Geometries for Omnidirectional Around-Corner Automotive Radar.” ACM Mobisys, 2022. (22% acceptance rate.)
- **Timothy Woodford**, Xinyu Zhang, Eugene Chai, Karthikeyan Sundaresan, and Amir Khojastepour. “SpaceBeam: LiDAR-driven One-shot mmWave Beam Management.” ACM Mobisys, 2021. (22% acceptance rate.)
- Renjie Zhao, **Timothy Woodford**, Teng Wei, Kun Qian, and Xinyu Zhang. “M-Cube: A Millimeter-Wave Massive MIMO Software Radio.” ACM MobiCom, 2020. (Best paper award, out of 384 submissions.)

Graduate Research

- 2018–2023 **M-Cube: mmWave Massive MIMO Software Radio.**
 - Built first-of-its-kind mmWave MIMO software-radio with up to 256 antenna elements
 - Reverse-engineered commercial 802.11ad radio and designed a flexible control channel to make it fully programmable
 - Achieved order-of-magnitude cost reduction over current commercial software radios
 - Providing tutorials and technical support to 15+ institutions who are using the M-Cube platform for experimental research.
- 2020–2023 **FPGA-based high-bandwidth baseband.**
 - Built 4 Gbps super-sampling rate (SSR) baseband on Xilinx RFSoc implementing both radar and 802.11 communications waveforms and signal processing
 - Developed data transfer mechanisms using Ethernet, PCIe, and AXI DMA

- 2019–2023 **AI-Operated mmWave Mesh Network.**
- Developed techniques needed to deploy reinforcement learning to control highly-dynamic mmWave backhaul networks
 - Created and validated methods for sim-to-real transfer of RL policies
 - Developed kernel- and system-level modules for software-defined mmWave mesh network
- 2021–2022 **Non-Line-of-Sight (NLoS) Automotive Radar Sensing.**
- Designed the first NLoS wireless sensing framework that harnesses arbitrary-shaped roadside reflectors and artificial reflectors
 - Created novel radar detection algorithms for NLoS scenarios
 - Designed fully-passive 3D printable metasurfaces and a novel spatial encoding algorithm for high-resolution NLoS sensing
 - Electromagnetic simulation and passive reflectarray design using ANSYS HFSS
 - Propagation modelling with custom SBR tool and Wireless InSite
 - Implementation and experimental validation using commercial automotive MIMO radar
- 2022 **Low-Power Neuromorphic Signal Processing.**
- Built FPGA-based capture system for low-power neuromorphic sensing

Experience

Professional

- 2023- **Satellite Communications Researcher**, *MIT Lincoln Laboratory*, Lexington, MA.
- Designed beamforming arrays for LEO constellation
 - Developed low-power user terminal for LEO communications
- 2020 **5G Networks Research**, *NEC Labs America*, Princeton, NJ.
- Developed novel RF ray-tracing methods to handle noisy 3D mesh data
 - Conducted experiments matching real-world RF propagation to 3D mesh models
 - Created detailed 3D reconstructions of indoor environments using RGBD camera
- 2017 **Wireless Communications Research**, *Air Force Research Lab*, Rome, NY.
- Designed and solved optimization model for improving directivity of graphene-based terahertz MIMO arrays
 - Characterized antenna patterns of millimeter-wave antenna array
- 2015–2016 **Signal Processing Intern**, *Johns Hopkins Applied Physics Lab*, Laurel, MD.
- Developed an algorithm for efficient reconstruction of intermittent GPS LNAV messages
 - Documented LNAV reconstruction algorithm for internal publication
 - Developed FPGA and embedded software for real-time software-defined radio application
 - Built and submitted Linux kernel patch to work around network card hardware bug

Teaching

- 2020–2022 **Teaching Assistant for ECE158B (Data Networks II)**, *UC San Diego*, San Diego, CA.
- Developed and delivered hands-on tutorials on Wireshark, Mininet, and NS3 tools

Relevant Coursework

UCSD Graduate Coursework.

- DSP, Linear Algebra, Random Processes, Wireless Networks, Parameter Estimation, Information Theory, Digital Communications

Bucknell **Undergraduate Coursework.**

- ECE: Linear Systems, Electricity & Magnetism, Embedded Systems, Digital Design
- Mathematics: Modern Statistical Methods, Partial Differential Equations, Linear Algebra

Awards

- 2018 UC San Diego Ph.D. Fellowship
- 2015 Jeffry James Harold Prize for Academic Achievement

Skills

- Programming C, Python, Verilog, Matlab, \LaTeX , Java, VHDL, C++, Shell scripting
- RF Testing Network analyzers, oscilloscopes, function generators, logic analyzers
- Simulation ANSYS HFSS, NS3, Wireless InSite
- Networks iperf, socket programming, SDN