

# Jack Rademacher

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## EDUCATION

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### Massachusetts Institute of Technology — Cambridge, MA

M.S./Ph.D Electrical Engineering and Computer Science

September 2021 — Present

- **Research:** Underwater acoustic communication systems and hardware platforms for complex problems in oceanography, naval defense, aquaculture, and climate monitoring

### University of Michigan — Ann Arbor, MI

B.S.E. Electrical Engineering, Summa Cum Laude

September 2017 — May 2022

## WORK EXPERIENCE

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### Analog Devices — Colorado Springs, CO

May 2021 — August 2021

Microwave Design Engineering Intern, Aerospace & Defense (ADEF) Business Unit

- Designed an integrated 6-14 GHz, 128 ps, 6 bit true-time delay unit for beamforming ASICs on a 45nm RF-SOI process
- Designed and simulated a time delay architecture not previously implemented by my team that improved layout area and time delay density by up to 45%
- Designed and simulated bypass networks for mimicking  $S_{21}$  of delay units and providing a flat differential time delay across 2ps, 4ps, 8ps, 16ps, 32ps, and 64ps units

### Analog Devices — Colorado Springs, CO

May 2020 — August 2020

Microwave Product Engineering Intern, Aerospace & Defense (ADEF) Business Unit

- Created a test setup for characterizing  $IP_3$  of beamforming ICs from 2-33GHz through PCBs or an RF probe
- Collected data on worst/average case input and output  $IP_3$  to within  $\pm 0.35$  dBm of actual value across frequency & power to compare with designers' simulations
- Communicated and displayed summer work to upper level management, showing how my test bench is accurate, easy to use, and can be used over wide range of bandwidths, power levels, and device form factors

### Apple — Sunnyvale, CA

Electrical Engineering Intern, Special Projects Group (SPG)

January 2019 — August 2019

- Designed the schematic and layout for a "wireless oscilloscope" PCB to measure and log voltage, current and temperature
- Wrote C to live-stream ADC samples to an SD card and wirelessly to a python application using the MQTT protocol
- Created a concurrent embedded application using FreeRTOS to manage ADC sampling, WIFI connectivity, wireless streaming & device control, SD card reading/writing, and RTC initialization using network time

## RESEARCH EXPERIENCE

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### Signal Kinetics at the MIT Media Lab — Massachusetts Institute of Technology

Graduate Research Assistant, advised by Fadel Adib

- Designed, built, and tested a first-of-its-kind passive underwater retrodirective acoustic beamformer to provide orientation-agnostic backscatter
- Developed a hydrophone beamforming array and algorithm to estimate and invert the underwater acoustic channel and maximum-ratio-combine for improved SNR
- Managed multiple undergraduate researchers to design and build a sub- $\mu$ W underwater backscatter temperature sensor
- Designed hardware platforms and signal processing algorithms for ultra low-power acoustic backscatter communication
- Designed a STM32L4 hardware platform for acoustic energy harvesting, low power imaging, and edge machine learning

### Power Electronics and Energy Research Studios (PEERS) — University of Michigan

Undergraduate Research Assistant, advised by Al-Thaddeus Avestruz

September 2020 — July 2021

- Formulated major loss mechanisms in a current-mode class D (CMCD) converter for wireless power transfer
- Optimized the design of the CMCD converter for high power & efficiency by compromising  $C_{OSS}$  and conduction losses, resulting in a design that exceeds the current state-of-the-art when examining power-efficiency-frequency product
- Designed a custom wireless power transfer 4-layer PCB coil in COMSOL to obtain the required inductance and coupling

## SKILLS

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**Programming Languages:** C/C++, Python, MATLAB, Java, HTML/CSS, JavaScript (React, ReactNative, NodeJS), Elm

**Software Packages:** Altium Designer, Cadence Allegro, Cadence Virtuoso, Keysight ADS, Solidworks, LTSpice, NI Labwindows/CVI, NI Max, Ansys HFSS, COMSOL E/M, Linux, Git