Julian A. Maravilla

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Education

- **UC Berkeley** — Berkeley, CA
  Ph.D. - Electrical Engineering and Computer Sciences — *August 2020 - Present*
  Research on Antenna Array Design in extreme environments including Improved Magnetic Resonance Imaging (MRI)
- **UC Santa Barbara** — Santa Barbara, CA
  Bachelors in Science - Electrical Engineering — *June 2020*
  Graduated with Highest Honors (top 2.5%), course emphasis on RF Circuit Design, Signals and Systems, and ML

Research Skills

- **RF Design**: Power and Noise Matching, Narrowband and Wideband RF PAs, LNA Design, Advanced Passive Filter Design, Antenna Design and Analysis, S-Parameter and RF measurements
- **Additive Manufacturing**: Electroless Metal Plating on flexible/rigid plastic substrates, Conductive Ink Screen Printing, 3D Printing (FDM, SLA), CNC Machining (metals and plastics), General Machine Shop and Wood Shop Tools, Plastic Thermoforming, CAD Tools including Fusion 360 and Solidworks
- **Integrated Circuit Design**: Analog IC Design, FPGA Implementation of Verilog, Computer Architecture, Feedback Circuits (Op-Amps and Transistor-Level implementation), Semiconductor Design and Analysis with Clean-room Experience (GaN substrates and devices)
- **Languages**: Python (includes Basic Machine Learning Implementations), C/C++, MATLAB, Verilog (FPGA Implementation)
- **Simulation Tools**: HFSS, CST, ADS, Xilinx ISE, LTSpice, PLECS, COMSOL
- **Image Reconstruction**: Magnetic Resonance Imaging reconstruction using efficient algorithms, RADAR signal processing, stochastic processing methods

Experience

- **Ph.D. Student - UC Berkeley (NSF and Chancellor's Fellow)** — Berkeley, CA
  SWARM Lab, BWRC, BETR — *August 2020 - Present*
  - **Antenna Design Research**: Developed and designed novel antenna topologies for use in body-conformal MRI receive arrays. Implemented and improved advanced antenna decoupling techniques to eliminate crosstalk between elements in tightly packed arrays. Novel designs can be implemented in a variety of RF applications.
  - **Improved MRI**: Utilized novel antenna designs to generate receive arrays for MRI. Improved the diagnostic quality of MR Images by designing arrays that maximize proximity to the body.
  - **Additive Manufacturing for Out-of-Plane Electronics**: Developed and optimized an additive manufacturing process for plating highly conductive traces on flexible/rigid plastic substrates. Allows for the design of non-planar PCBs that can conform to non-planar surfaces.
  - **Lab Safety Officer**: Developed lab safety trainings for 30+ individuals on heavy lab equipment including saws, 3D printers, and CNC machinery. Ensured proper maintenance and operation of lab equipment.
  - **Mentorship**: Mentored 5 undergraduate students interested in RF circuit design and improving MRI. Implemented a hands-on approach to mentoring such that mentees learn valuable lab/research skills for use during their own careers with emphasis on teaching and critical thinking. Mentored students go onto graduate school, industry, and/or present their work at research conferences.
- **Toyon Research Corporation** — Santa Barbara, CA
  Associate Analysis (Seasonal) — *June 2018 - Present*
  - **E/M Simulations and RF Filters**: Created a workflow to quickly simulate and develop passive RF filters for use in RADAR and communications. High-order filters were designed and optimized using this workflow with cutoff frequencies of +30GHz.
  - **RF Measurements**: Characterized Antennas and RF Devices using a network analyzer.
  - **Semiconductor Design and Analysis**: Characterized Gallium Nitride (GaN) varactor devices at extremely high frequencies (+60GHz). Utilized UCSB's Nanofab to develop devices using photolithography and Chemical vapor deposition (CVD) on GaN substrate.
- **UCSB's Imaging Systems Lab** — Santa Barbara, CA
  Undergraduate Researcher — *January 2019 - June 2020*
  - **Sensor Fusion**: Conducted research on sensors and combining sensors for use in medical devices.
  - **Signal Processing**: Processed the latest RADAR data to form new algorithms for image formation.
  - **Acoustic Beamforming**: Designed a beamforming circular array as a stethoscope replacement. Final design won outstanding innovation for UCSB's Senior Capstone.
- **Superior Machined Products Inc.** — Oceanside, CA
  Assistant Machinist/Engineer — *June 2016 - September 2017*
  - **CNC Machine Operator**: Operated and maintained various CNC lathes to manufacture and produce precision components including dental implants and surgical tools.
  - **CAD Modeling and Drawing**: Utilized CAD tools to prototype novel dental implant designs including detailed drawings using international standards (ISO).

Projects

- **15-Channel Wearable Head Array for MRI**: Novel Twisted-Pair receive antennas were designed and manufactured to produce highly flexible and conformal receiver coils for MRI. The coils were placed on a head cap to maximize proximity to the head, while remaining comfortable. Departure from traditional rigid head coils yields a head array capable of being used for a combined TMS/EEG/fMRI system and for use in fMRI sleep studies. Results from the coil were shared at an ISMRM Workshop on Neuralmodulation (Oral Presentation, October '22), and will be published in MRM. (Work in progress)
- **8-Channel Thermoformed Head Coil Array for MRI**: Fabricated and designed an 8-Channel Thermoformed Head Coil Array for MRI. An 8-Channel coil pattern was electrolessly plated on a thermoformed plastic substrate perfectly molded an individual's head. The plated traces are interconnected with capacitors to make the structures resonant to NMR signal (tuned coils). The close promixity of the coils to the body lead to increased SNR performance when imaging the visual cortex. Results to be published in MRM. (August '21)
- **Flexible Tunable Capacitor**: Designed and fabricated a Flexible Tunable Capacitor using a low-loss flexible dielectric substrate (Pyralux). Provided a range of capacitor values from 1 pF to 10 pF with a step size of 0.2 pF. The flexible structure was able to conform to non-Cartesian RF structures in order to provide a high Q variable capacitor. Results were published at a leading MRI hardware conference (ISMRM). (May '21)
- **Acoustic Beamforming Array for Monitoring the Heart**: Developed, designed, and implemented acoustic sensors in an array to perform beamforming on heartbeat signals. Sum-and-delay beamforming reduced the noise floor of incoming acoustic heartbeat signals which can reveal heart conditions that are usually masked by noise (aortic regurgitation). (October '19)
- **FedPAQ Algorithm for Distributed Learning**: Generated a Python script that implements a Federated Learning algorithm with Periodic Averaging and Quantization to train on the CIFAR-10 dataset for demonstration. Alleviated the communication bottleneck and scalability issues associated with Federated Learning. Scalable for implementation on large datasets and many devices. (October '19)
- **Gallium Nitride (GaN) Variable Capacitor**: Fabricated Gallium Nitride Variable Capacitors at UCSB's Nanofab Clean Room. Measured C-V curves, and RF measurements of the devices up to 60GHz. Aided in the design and simulation of the devices, goal is to produce high Q Variable Capacitors for operation in V and W bands. (August '19)
- **Compact Distributed Element Diplexer**: Designed, iterated, and manufactured a compact diplexer with passbands of 6-18GHz and 30-40GHz using a low-loss dielectric substrate and periodic transmission line structures. Passbands had low attenuation (<1 dB) and a match of at least -10 dB. (August '19)

Publications

- **Maravilla, J.**, Gopalan, K., Arias, A. C., & Lustig, M. (2022). Transmission Line Coils (TLCs) for MRI. The 30th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), London, United Kingdom. Abstract no. 0189
- Kaveh, R., Tetreault, N., Gopalan, K., **Maravilla, J.**, Lustig, M., Muller, R., & Arias, A. C. (2022). Rapid and Scalable Fabrication of Low Impedance, 3D Dry Electrodes for Physiological Sensing. Advanced Materials Technologies, 2200342.
- Gopalan, K., **Maravilla, J.**, Mendelsohn, J., Arias, A. C., & Lustig, M. (2021, August). Vacuum Formed Coils for Magnetic Resonance Imaging. In 2021 International Conference on Electromagnetics in Advanced Applications (ICEAA) (pp. 327-330). IEEE.
- **Maravilla, J.**, Gopalan, K., Arias, A. C., & Lustig, M. (2021). Flexible Tunable Capacitor: A Variable Capacitor for Tuning Flexible/Thermoformed MRI Coils. The 29th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM). Abstract no. 1410
- **Maravilla, J.**, Shimada, H., & Lee, H. (2019). LIDAR Collision Avoidance System with Audio Feedback For The Visually Impaired. International Telemetering Conference Proceedings. 55.

Honors and Awards

- National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Recipient - March 2021
- Chancellor's Fellowship, University of California, Berkeley - August 2020
- EECS Excellence Award, University of California, Berkeley - August 2020
- Highest Honors (top 2.5% of graduating class), University of California, Santa Barbara - June 2020
- Outstanding Innovation, University of California, Santa Barbara Electrical Engineering Senior Capstone - June 2020