Sidhi (Sid) Assawaworrarit

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Education

2021	Ph.D. in Electrical Engineering	Stanford University
2016	M.S. in Electrical Engineering	Stanford University
2014	B.S. in Electrical Engineering	California Institute of Technology

Employment

Feb 2021 - present	Postdoctoral Scholar	Stanford University

Publications

Peer-Reviewed Articles (*=equal contribution)

1. Z. Omair, **SA**, L. Fan, W. Jin, and S. Fan, 'Radiative-cooling-based nighttime electricity generation with power density exceeding 100 mW/m^2', iScience, in press.
2. **SA**, Z. Omair, and S. Fan, 'Nighttime electric power generation at a density of 50 mW/m2 via radiative cooling of a photovoltaic cell', Appl. Phys. Lett., vol. 120, no. 14, p. 143901, Apr. 2022.
3. B. Zhao*, **SA***, P. Santhanam, M. Orenstein, and S. Fan, 'High-performance photonic transformers for DC voltage conversion', Nat. Commun., vol. 12, no. 1, p. 4684, Aug. 2021.
4. **SA** and S. Fan, 'Robust and efficient wireless power transfer using a switch-mode implementation of a nonlinear parity–time symmetric circuit', Nat. Electron., vol. 3, no. 5, May 2020.
5. H. Wang, **SA**, and S. Fan, 'Dynamics for encircling an exceptional point in a nonlinear non-Hermitian system', Opt. Lett., vol. 44, no. 3, pp. 638–641, Feb. 2019.
6. **SA**, X. Yu, and S. Fan, 'Robust wireless power transfer using a nonlinear parity–time-symmetric circuit', Nature, vol. 546, no. 7658, Jun. 2017.
7. R. Horstmeyer, B. Judkewitz, I. M. Vellekoop, **SA**, and C. Yang, 'Physical key-protected one-time pad', Sci. Rep., vol. 3, no. 1, Dec. 2013.
8. **SA** and S. Padin, 'An Optical Pointing Telescope for Radio Astronomy', PASP, vol. 124, no. 913, pp. 242–246, Mar. 2012.

Conference Presentations

1. **SA** and S. Fan, 'Robust wireless power transfer based on parity-time symmetry' in METAMAT 2021. (invited)
2. **SA** and S. Fan, 'Robust and efficient wireless power transfer with Parity-Time symmetry' in METANANO 2020. (invited)
3. H. Wang, **SA**, S. Fan, 'Dynamics for encircling an exceptional point in a nonlinear non-Hermitian system' in CLECO 2020. H. Wang, **SA** & S. Fan. *CLEO* 2020.

Patents

1. S. Fan, B. Zhao, **SA**, ‘Apparatuses and methods involving dc voltage conversion using photonic transformers.’ U.S. Patent Application No. 17/541,521.
2. S. Fan, **SA**, X. Yu, ‘Methods and apparatuses for wireless transfer of power.’ U.S. Patent No. 10,931,146.

Research Topics

Ambient energy harvesting from radiative cooling

The Earth’s atmosphere is partially transparent to thermal radiation, allowing radiations in the 8 – 13 µm wavelength range to pass though unabsorbed. Objects emitting in this range will radiatively cool down below ambient at night when exposed to the sky. We can use a thermoelectric generator to harvest the resulting temperature difference and generate usable electrical energy. We show that standard silicon solar cells radiatively cool at night; thus, a solar cell can be coaxed to generate power at night (APL 120, 2022). We conduct a system analysis to derive an optimal design that maximizes the power density and present a prototype that achieves 100+ mW/m^2 (iScience 25, 2022).

Robust wireless power transfer

Wireless charging gives us the convenience of power delivery without the need to plug in. In most implementations, the optimal system parameters such as the frequency and load factor depend sensitively to the magnetic field coupling between the source and load. Thus, a device must remain fixed with respect to the source whilst charging or a tuning circuit must be used to ensure efficient power transfer. We pioneer a new wireless power transfer framework based on amplifier saturation (Nature 546, 2017). The interaction between the energy gain from the amplifier and the energy sink from the load is described using the concept of Parity-Time (PT) symmetry. From this interaction emerges a power-transfer state that self-adjusts to the prevailing magnetic field coupling, and the power transfer occurs as emergent as opposed to being externally imposed, allowing it to quickly adapt to dynamically varying transfer distance between the source and load. We follow up with a high end-to-end efficiency design (Nat. Electron. 3, 2020).

Teaching & Mentoring Experience

- Research mentor and supervisor for a high school student, Stanford, Summer 2022
- Teaching assistant for Guided Waves (EE153), Stanford, Winter 2017
- Teaching assistant for Microwave Engineering (EE153), Caltech, Spring 2014

Selected Course & Personal Projects

Programming:

- FDTD & FDFD Electromagnetic simulators. Built finite-difference time- and frequency-domain electromagnetic simulators in MATLAB. Used the simulators to study bandgap engineering in a photonic crystal structure and to design an ultra-high-Q-factor photonic cavity, 2017.

Optical system:

- Confocal microscope. Built a confocal microscope setup using an optical fiber in place of a pin hole for axial (depth) resolution. Presented a final project on the microscope design along with images taken using the microscope, 2016.

Technical Skills

Modeling and simulation software: Solidworks, Comsol, Zemax, Lumerical

Programming languages: MATLAB, Python, C, C++

Updated: July 2022