



Research Overview

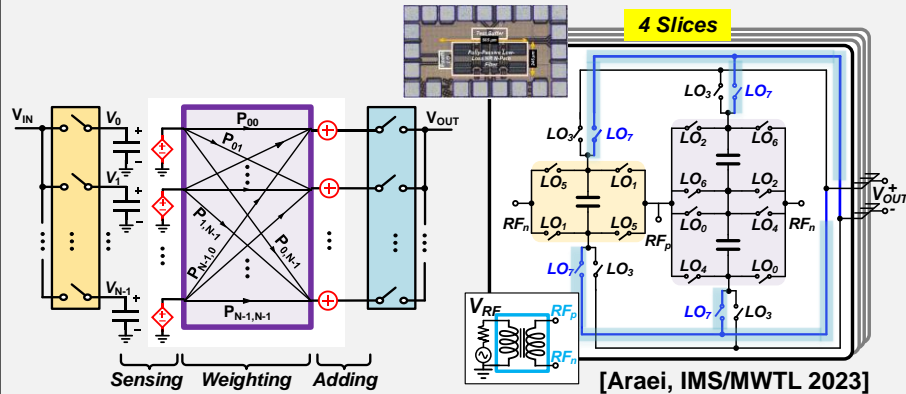
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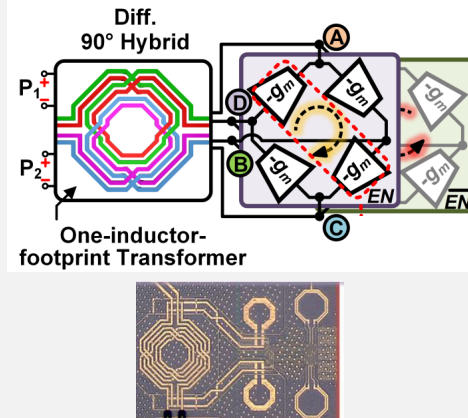
Research Thrusts

Circuit Topologies Based on Time-Modulated Commutation Schemes



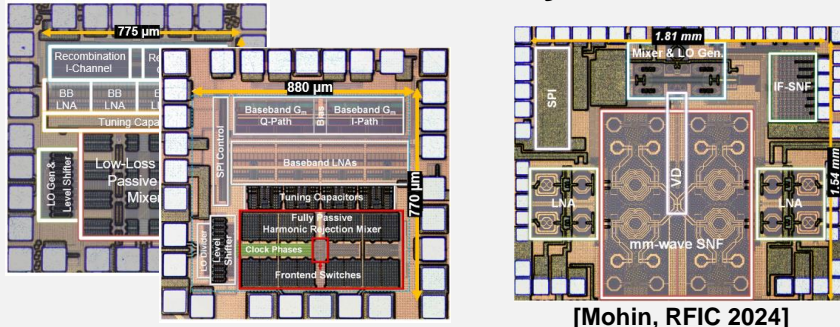
Generalize linear periodically time-varying LPTV circuit design.

Compact, Low-Power mm-Wave Nonreciprocal Components



	This Work	[Dinc, JSSC 2017]
Frequency (GHz)	27-31	22.7-27.3
Phase-shift	Tunable	Fixed
Power (mW)	<14	78
Area (mm ²)	0.21	1.3

Interference Mitigation in Wireless Communication Systems



[Araei, ISSCC 2023, ISSCC 2024, JSSC 2023]

Harmonic-resilient RF radios for wideband software-defined radios

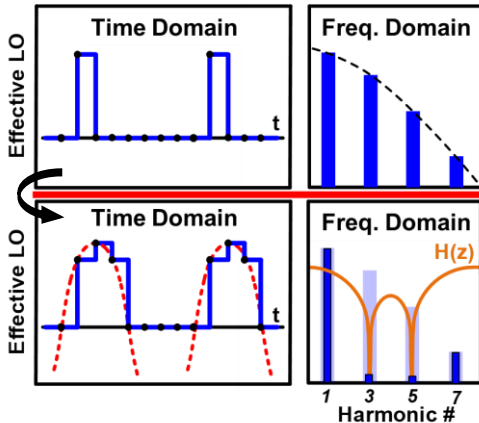
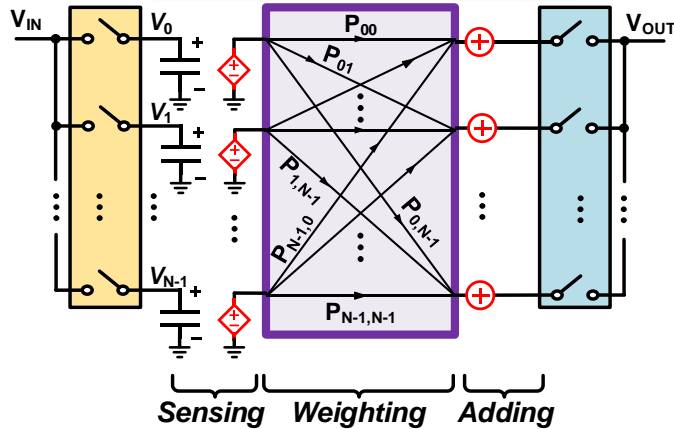
Mm-wave MIMO RX with spatial notch filtering

Other Ongoing Projects

- Miniaturization of microwave imaging systems for cancer detection in collab. with Draper
- Machine learning-based phased-array radar with beamforming for vital sign detection, in collab. with A. Chandrakasan
- Exploring parity-time symmetry in coupled-oscillator systems
- High-selectivity, wide-band RF receivers

LPTV Circuit Synthesis using an FIR Filter Approach

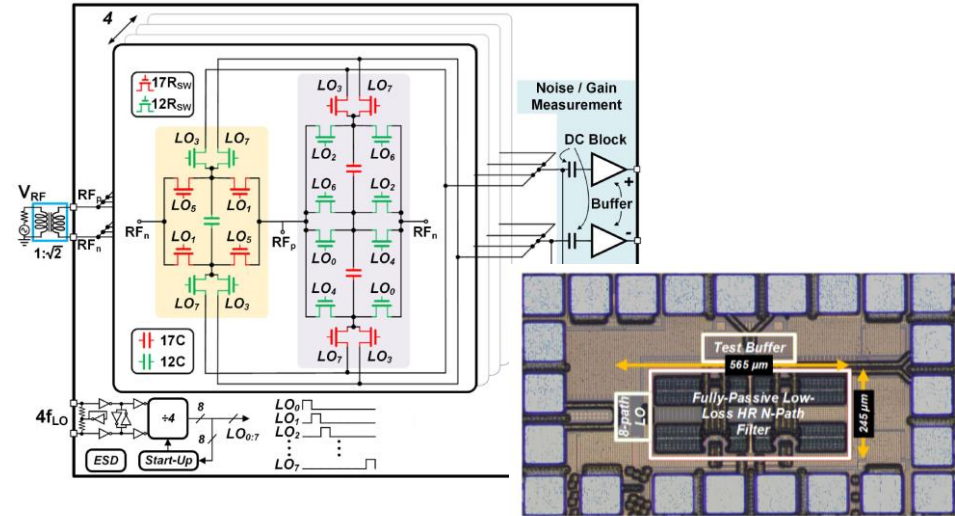
Concept



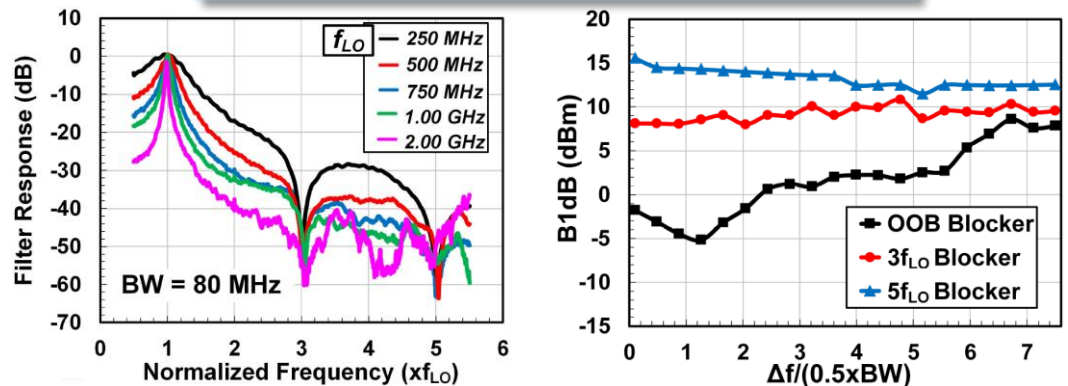
FIR Filter Synthesized for Harmonic Rejection:

$$H(z) = 1 + \sqrt{2}z^{-1} + z^{-2}$$

Block Diagram and Chip Photo

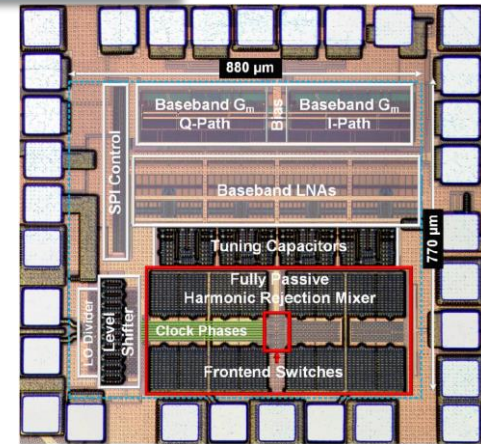
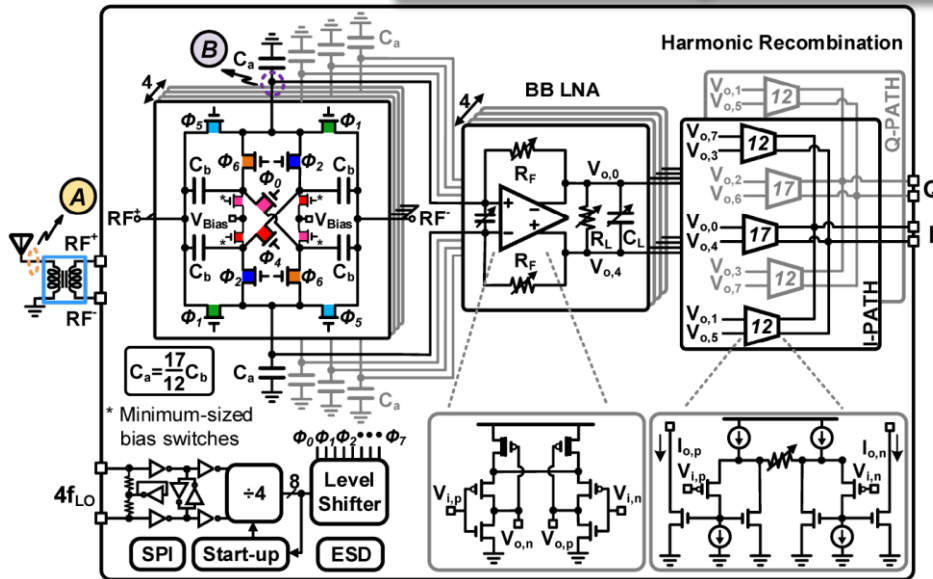


Measured Results



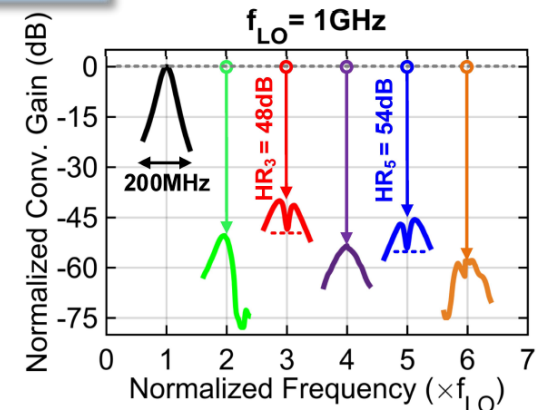
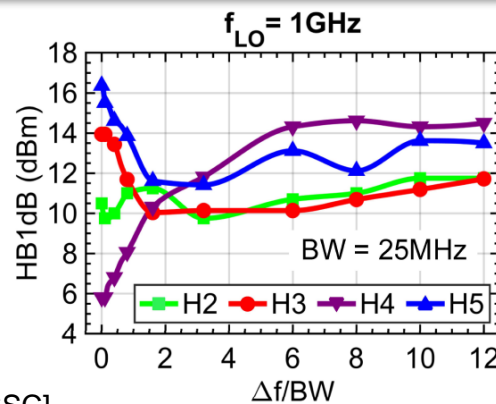
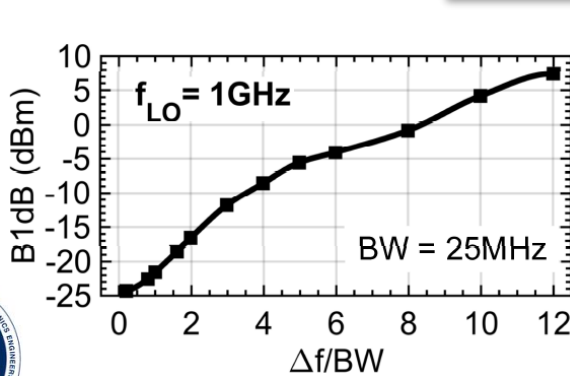
Harmonic-Resilient RX with Built-In HR at Antenna and BB

Block Diagram and Chip Photo



100x higher than previous state-of-the-art broadband HR receivers.

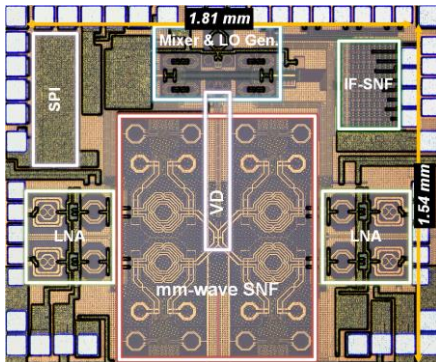
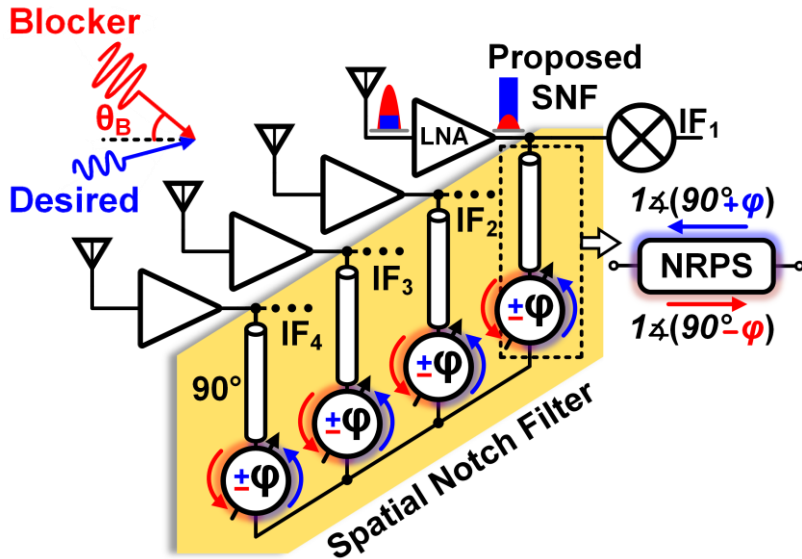
Measured Performance



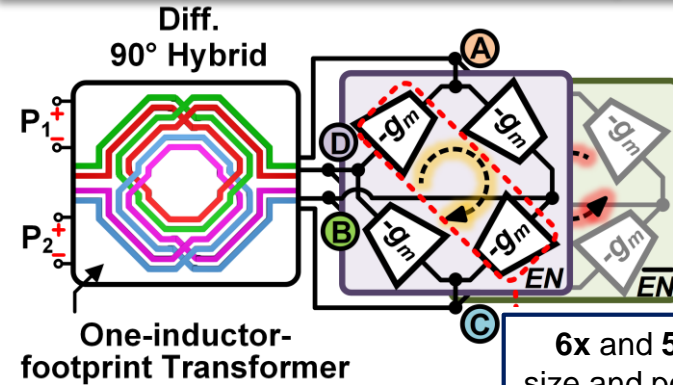
Ref: ISSCC 2024, Invited and submitted to JSSC]

Interference Mitigation in Digital/MIMO mm-Wave Arrays

Conceptual Diagram and Chip Photo

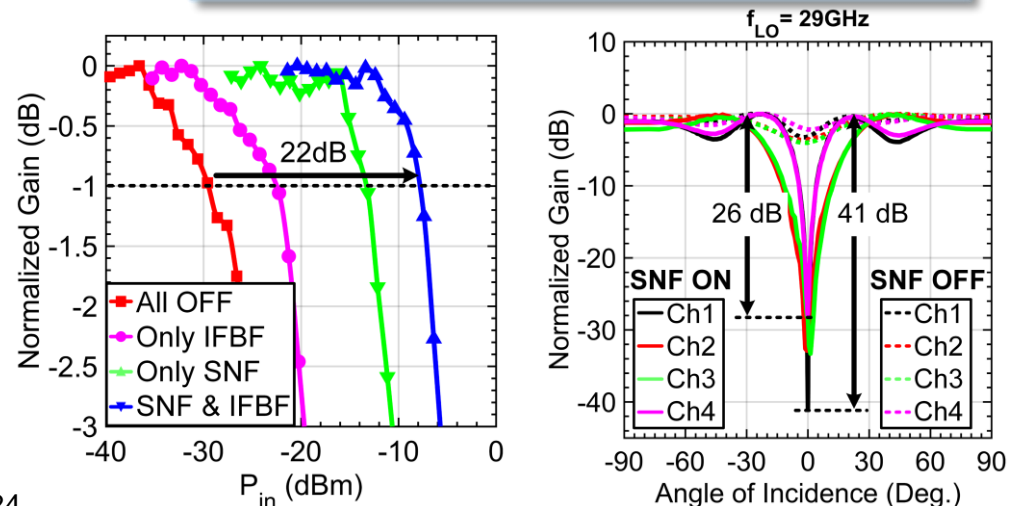


Nonreciprocal Phase-Shifter (NRPS)



6x and 5.6x reduction in size and power consumption compared to prior work.

Measured Performance



4x higher blocker tolerance than prior fully-integrated state-of-the-art.

Radius Lab Group Members

- Postdocs:
 - Mohammad Barzgari
- PhD students:
 - Soroush Araei
 - Shahabeddin Mohin
 - Haibo Yang
 - Sarina Sabouri (co-advised with A. Chandrakasan)
 - Melania St. Cyr

