Research highlights

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1.CMOS-based Instrumentation Amplifiers (INAs) for wearable biomedical devices: In the design of signal conditioning circuits for wearable applications, the exists a strong trade-off between noise and power specifications. To this end, we are working on some design methodologies to optimize the said trade-off. With the emergence of a high density of wireless network devices, EMI effects on front-end electronics are critical, leading us to explore EMI aspects in CMOS circuit.

2.Neural signal recording and stimulation: The next paradigm of human-computer interfacing is between biological neurons and electronics. The advancements in the scientific literature on this topic and technology demonstrations by start-up like Neuralink make this field very promising. To this end, we have been working on the design of CMOS based neural amplifiers and stimulator circuits.

3.CMOS-based Neuromorphic circuit design: With the emergence of AI and ML, there has been a significant interest in developing non-Von Neumann architecture-based computational platforms. We are working on various aspects of fully CMOS compatible NM computing system like silicon neurons, memristor-based synaptic weights, on-chip learning circuits, and cross-bar array design considering parasitics, encoder and decoder circuits for interfacing the NM computing platform with the real world.

4.Indigenous IC development using SCL process: We are developing radiation-hardened analog signal conditioning front-end ASICs for high-precision instrumentation for space applications. As a ring-oscillator is considered a good test-circuit for CMOS technology characterization, we have designed an all-digital temperature sensor using 180 nm SCL PDK. The post-layout simulation results agree well with analytical derivations, and the proposed design has been tested for robustness by simulating across PVT variations. By Monte-Carlo analysis, we have ensured design tolerance against mismatches.