Future Directions for Silicon Radio Frequency Electronics

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Abstract: Growth in mobile communication and computing technologies over the past two decades has been driven by innovations in system architectures, software technology, and silicon integration. Examples of adaptive, wideband, and scalable high-frequency electronic designs relevant to emergent 5G (fifth-generation wireless) and IoT (internet of things) applications are described in this talk. Wideband, mm-wave technologies may enable the next generation of wireless infrastructure. A representative example is a recently developed mm-wave all-digital phase-locked loop ADPLL with self-calibration circuits in deep-submicron CMOS. The ADPLL performs autonomous calibration and closed-loop DCO gain linearization, and achieves excellent in-band/ out-of-band phase noise performance. Scenarios for improving health care often require low-power radios to monitor patients remotely. In the second example, a low-power, autonomous FM ultrawideband transceiver and power management unit that transfers data reliably at 100kbit/s and includes full on-chip digital calibration of the transceiver is described. Finally, fibre-optic technologies in the internet backbone are migrating towards coherent modulation schemes to increase data throughput. A silicon IC driver capable of producing the 6Vp-p output required to drive a Mach-Zehnder optical modulator is presented. Based on a distributed amplifier architecture, the novel all-digital input interface enables sub-10ps rise/fall times on a silicon IC platform capable of full transceiver integration.