Title: More than CMOS: hybrid CMOS chips for biomedical applications

Abstract: Nanotechnology advances have been validating Moore's law by allowing the downscaling of transistor sizes to below 10 nm, and in parallel have also been allowing the manufacturing of nanometer scale transducers, such as nanoelectromechanical systems (NEMS), magnetic and optical transducers. However, the System on Chip (SoC) definition is normally attributed to the integration of all the building blocks of an electronic system into a single chip, whereas the transducers are typically implemented in a separate chip, which is mounted very close together to the electronic SoC on a specific PCB/socket. While this paradigm is well stablished in both academic and industrial worlds, several efforts have been employed into expanding the SoC definition to both electronics and transducers by implementing them on a single hybrid chip, more specifically where the transducer material cannot be found in the typical CMOS process, thus requiring post-fabrication of the CMOS chips after receiving them from the foundry. This is a key requirement for many applications where high spatial density and very high number of transducers are required, such as a great number of biomedical applications. Here, two implementations are described where hybrid devices are designed and built: a biomolecular recognition detection chip using CMOS and magnetic sensors technology, and an ultrasound based neuronal stimulator using CMOS and piezoelectric transducers technology.