Project proposal – Memristor-based Tunable CMOS RF Amplifiers

The growing demand to connect up the world is pushing wireless systems to be smaller than ever. This is part of the increasing move to a data driven world with billions of connected devices in the era of the Internet of Things (IoT) and space and energy are critical design criteria. Traditionally, miniaturization was possible owing to a focus in a single frequency and a single communication protocol. However, the real challenge is scaling multi-frequency/multi-protocol RF systems. It is highly desirable to have adaptable RF-chains, which means adaptable filters, amplifiers, matching networks, etc.

CMOS is widely used as low noise, low-power, and high power gain amplifiers. A critical design tradeoff in RF amplifier exists between stability, noise, power, linearity specifications. Memristive devices are two terminal passive circuit elements, whose resistance is determined by the history of the applied voltage or current, and is retained whenever the voltage or current is no longer applied (non-volatility). Nanoscale memristive radio-frequency switches have proven to achieve low insertion loss, high isolation and high cutoff frequency, while adding the characteristic non-volatility, low-energy switching, and small footprint of memristors

In this project a tunable RF amplification stage will be designed and evaluated. Both stabilization techniques and matching networks will be implemented by memristor-based circuits. The project is based on advanced research. The implementation will be done in Virtuoso and/or ADS.

Schedule:

- Design of a generic RFCMOS amplification stage. Evaluation of performance, stability and noise.
- Study of different stabilization techniques. Implementation of an integration technique with a memristor-based circuit.
- Implementation of memristor-based input and output multiband matching network.
- Evaluation of the complete RF amplifier.

Prerequisites: Linear electric circuits **Recommended:** RFIC

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