

# Tunable MIM/MOM Capacitors using Memristive Switches

Capacitors are fundamental passive devices in radio frequency integrated circuits (RFIC), extensively used in filters, tuned amplifiers, and mixers. Tunable capacitors (e.g., varactors) are essential in voltage-controlled oscillators (VCOs) and in other reconfigurable applications. VCOs are typically built using varactors which suffer from low quality-factor (Q) that reduces the performance. Conversely, metal-plate capacitors provide high Q and high capacitance values.

Memristive devices are two-terminal passive circuit elements with varying resistance, which depends on a state variable. The state varies according to the history of the applied voltage or current stimuli and is retained whenever the voltage or current is no longer applied. Recently, memristive devices have emerged as promising candidates for RF switches. Since they can be fabricated in the back-end-of-line (BEOL) of CMOS process they could be used as variable vias to reconfigure the capacitance of MIM/MOM capacitors.

In this project the students will evaluate and design a MIM/MOM capacitor with memristive-via switch. The project is based on advanced research. The implementation will be done in Virtuoso and/or ADS.

## Schedule:

- Study of the state-of-the-art MIM/MOM capacitors and RF memristive switches.
- Design, implementation and evaluation of a tunable MIM capacitor while aiming for:
  - High tunability ratio  $C_{Max}/C_{Min}$
  - High Q
  - Number of states

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

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