Resumen de Tesis Doctoral

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Título de la tesis	Design and Prototyping of BEOL-Embedded CMOS-MEMS Accelerometers
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(Mínimo 1 y màximo 4, podéis verlos en http://doctorat.upc.edu/gestion-academica/carpeta-impresos/tesis-matricula-y-deposito/codigos-unesco)

Resumen de la tesis de 4000 caracteres máximo (si se superan los 4000 se cortará automáticamente)

In the last two decades, MicroElectroMechanical Systems (MEMS) accelerometers and other inertial sensors have demonstrated a steady trend of miniaturization as well as price and power consumption reduction, while maintaining other performance parameters. This triggered their ubiquitous use in high-volume consumer electronics devices like smart phones, tablets, video game consoles or wearables to name a few.

Currently one of the bottlenecks to maintain the price and size reduction trends is a necessity of using a custom MEMS fabrication process.
The commercial MEMS accelerometers and gyroscopes are either multi-chip modules or a separate MEMS process is applied to the same wafer in order to deploy the sensor next to the electronics.

CMOS micromachining, where standard CMOS back-end of line (BEOL) interconnection layers are used as MEMS structural and sacrificial materials could be a possible breakthrough. An approach based on reactive ion etching of full interconnection stack followed by a substrate etching is currently the most-popular CMOS-MEMS integration method, however due to its limitations it has not reached significant success outside the academia. More recently with the advent of RF-oriented microelectronic technologies significant effort has been made to develop RF-MEMS devices like switches or resonators by using simple isotropic etching of inter-metal dielectric (IMD) of the CMOS BEOL. In this thesis it is demonstrated that thanks to the appearance of thick metal and via layers used normally for inductors and power routing used in these technologies, this method can be also applied to integrate on-chip microaccelerometers. The main advantage of the pursued approach is the technological simplicity, that results in potentially ultra-low production cost and feasibility (not demonstrated yet though) of deploying the sensor above electronics (as no substrate etching is required). Such devices could become new IP cores ready-to-integrate in more complex SoCs.

This dissertation presents a design and prototyping process of CMOS monolithic acceleration sensors obtained using a simple isotropic IMD etching of CMOS BEOL interconnection stack without any substrate etching steps. To the best of the author's knowledge such devices had not been reported before this work. The development starts from the MEMS post-CMOS process development and characterization that lead to first working acceleration sensor prototypes, which are further integrated on one chip with the sensing electronics. The final integrated devices, capable of 3-axis sensing, exhibit acceleration noise below 80 uG/rt-Hz at 1.38 mW power consumption per axis and show a room for further improvement.

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