Institute of Microelectronics of Barcelona IMB-CNM CSIC

The **IMB-CNM** is the largest institute in Spain dedicated to the research and development of Micro and Nano Technologies and Microsystems and with unique capabilities in silicon technology. It belongs to CSIC since its foundation in 1985 and is distinguished as a María de Maeztu Unit of Excellence.

IMB-CNM aims to contribute to the advancement of knowledge and to the economic and social development of society, as well as to the training of researchers and engineers and to the advice to public and private entities.

The research activities of IMB-CNM are dedicated to Micro/Nano Integrated Systems: miniaturized electronic systems which include sensing and/or actuating capabilities in addition to electronic information processing, power management and external interfaces.

The IMB-CNM is located on the Autonomous University of Barcelona (UAB) Campus and contains the largest clean room facilities in Spain with full capability to process its own CMOS technologies and laboratories.

Project Type: TFG/TFM

Project Title: A Low-Distortion Audio DAC IP Block in 22nm CMOS Technology for RISC-V Systems-on-Chip

Research Group: Integrated Circuits and Systems (ICAS)

Project Description:

- The role of edge-of-the-cloud devices and the corresponding generation of big data are expected to include more than 10% of the world economy by 2030. In general, the massive deployment of ubiquitous smart SoCs often requires cost-effective power-efficient D/A converters (DACs) capable of handling large dynamic range signals (typ. >80dB) but with practical bandwidth values not exceeding the kHz range, as in audio applications.
- Oversampling Delta-Sigma (ΔΣ) modulators, and in particular multi-stage shaping (MASH) solutions, are well-suited DAC architectures for these scenarios. This work will design a 14-bit 20-kHz ΔΣ MASH DAC circuit as a mixed-signal IP block in 22-nm 0.8-V CMOS technology. The design efforts will be focused not only on low-power operation and compact area, but also on scalability with respect to technology and supply voltage.
- Furthermore, the DAC IP structure will ease its integration in a RISC-V SoC by including the flash DAC stage and reconstruction filter at the analogue frontend, so commercial audio speakers can be employed, together with a digital interpolator and AXI-4 Lite slave at the digital backend.

Work Plan:

- The student will design the analogue, mixed-signal and digital parts of the ΔΣ MASH DAC IP circuit in a given 22-nm 0.8-V CMOS technology following the full-custom and semi-custom IC design methodologies through Cadence EDA tools.
- Apart from low-power operation and compact area, the schematic and layout design will be optimized for its robustness against process-supply-temperature (PVT) variations.
- All the above tasks will be performed in the IMB-CNM lab facilities at the UAB Bellaterra Campus.

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Candidate desired studies:

- ✓ MSc Semiconductor Engineering and Microelectronic Design
- ✓ MSc Research and Innovation in Computer-Based Science and Engineering
- ✓ MSc Telecommunications Engineering
- ✓ BSc Electronic Engineering in Telecommunications
- ✓ BSc Industrial Electronics and Automation Engineering

Application Process:

Before applying, please **check with your TFG/TFM program supervisor,** as he/she may already be coordinating with us to assign the project.

If there is no such coordination**, complete this form and send your CV and a motivation letter** to **Talent@imb-cnm.csic.es**, with the **subject: "TFG/TFM at IMB-CNM"**

Your CV will be forwarded to the Researcher leading the project who will contact you directly if interested.

Check our website for more information about the IMB-CNM and our research activities

https://www.imb-cnm.csic.es/en

Take the next step in your research career with us!

*By applying, you accept our data protection policy.

**IMB-CNM (CSIC) adheres to the European Charter and Code of Conduct for Researchers, ensuring full alignment with their principles and requirements, including equal opportunity, transparency, merit and ability, caring for an open, fair, and excellence-based hiring processes.

IMB-CNM holds the HR Excellence in Research award, which acknowledges CSIC's commitment to continuous improvement in HR strategies for researchers.

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