

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

MUR DM 117/STMicroelectronics - Ultra-Low Power Integrated Circuits for Next-Generation Biosensors

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] STMICROELECTRONICS S.R.L. [P.iva/CF:00951900968] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	<p>The PhD research deals with the design of innovative analog and mixed-signal integrated circuits operating at ultra-low power supply voltage and with an extremely low power consumption, so that to meet the requirements of next-generation, energy autonomous, environmentally friendly biosensors.</p> <p>Progetto finanziato nell'ambito del PNRR – DM 117/2023 - CUP E14D23002000004</p>
Objectives	<p>The PhD project is focused on the design of novel-in-concept analog and mixed-signal integrated circuits (ICs) operating down to a very low power supply voltage ($\ll 1V$) and with an extremely low power consumption (order of nW), aiming to address the requirements of next-generation, energy-autonomous, ultra-miniature wearable and implantable biosensors for the continuous monitoring of the physical activity and of quantities of clinical interest (e.g., the blood concentration of glucose, ions, drugs...). In particular, the research is expected to develop ground-breaking IC technologies enabling biosensors which operate without batteries, directly harvesting from the environment the very limited amount of energy needed for their operation.</p> <p>In this context, the PhD activity will address the co-design of innovative analog integrated circuits based on digitally-assisted solutions and new sensors that allow to reduce area occupation and power consumption by orders of magnitude compared to state-of-the-art technologies, while guaranteeing a level of performance and accuracy compatible with the applications.</p>

The PhD project involves the theoretical study of integrated circuits for state-of-the-art, digital-based biosensor front-ends and the exploration of novel front-end architectures (activity mainly carried out at Politecnico di Torino), the study of the characteristics of innovative electrochemical biosensors (activity mainly carried out at EPFL (Lausanne, CH) in the period abroad), and the development, simulation, physical layout, verification and fabrication of the innovative solutions in CMOS technology (activity carried out at STMicroelectronics, Cornaredo site (MI)). The PhD research will be completed by the experimental validation of the novel circuits, both in the lab and in the field, and with the presentation of the results in top international conferences and international journals in the circuits and systems and solid-state circuits area.

Skills and competencies for the development of the activity

Excellent academic background in Electrical/Electronic Engineering, with a special focus on IC design. Familiarity with the analog, digital and mixed-signal IC design and simulation flow.