DEIB

ELECTRONICS RESEARCH AREA

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The scientific roots of DEIB research activities in Electronics date back to 1957 when Emilio Gatti was appointed to the first Professorship of Electronics in Italy. Following his vision, Electronics research at DEIB has always been carried out through a balanced mix of theoretical analysis and experimental activities.
Today, the research activity is carried out in 1400 square meters of laboratories equipped with state-of-the-art tools to design, simulate, and characterize the electrical and optical properties of a broad range of nano- and opto-electronic devices, sensors, integrated circuits, and systems. Devices and integrated circuits are fabricated either in the University's clean room, PoliFab, or in collaboration with major semiconductor companies and research institutions.
A Faculty of 23 professors, supported by more than 60 Ph.D. students and post-doc researchers, teaches about forty courses on various subjects of Electronics Engineering at undergraduate and graduate level.
The research activities of the Electronics area are organized in six major lines:

• Electron Devices exploits current and emerging technologies for non-volatile memories and organic electronics. On the one hand, the research is aimed at predicting the reliability and guiding the scaling behavior of main memory technologies including PCM, resistive RAM, magnetic RAM, capacitor-less DRAMs and 3D devices. On the other hand, a particular eamphasis is given on advanced optoelectronic functionalities realized by means of scalable, printing techniques.
• Smart Microsensors and Microsystems addresses the key aspects of sensors and front-end circuits development to support the integration of novel and/or multiple functionalities on the same electronic system (System on Chip – SoC) in particular for mechanical (MEMS), optical (CMOS), and magnetic (AMR) sensors.
• Electronic Circuits Design exploits the CMOS scaling below 50 nanometers in the field of radio-frequency applications (e.g. 5G) and in the area of low-power, low-noise integrated circuits for microsensor interfaces (e.g. IoT and wearables).
• Single-Photon Detectors develops single-photon avalanche diodes (SPADs) and associated electronic systems for detecting visible and infrared radiation down to the single particle of light. The focus is on the conception of innovative detector structure, fabrication technologies, and circuit architectures for high detection efficiency, picosecond temporal resolution, and scaling toward large size imagers. Applications are in life science, quantum information processing, LiDAR and 3D imaging.
• Radiation Detectors develops new imaging detectors for charged particles and ionizing radiation (X-rays, Gamma-rays), the related low-noise electronics and the full imaging system. The focus is both on the study and the design of novel detector topologies and on the characterization, setup and application of state-of-the art detectors. Applications are in medical imaging, astronomy, material analysis, and nuclear physics.
• Digital Systems uses programmable electronics (microcontrollers, DSPs, and FPGAs) in the areas of radiation detection, medical imaging, energy management for automotive electric systems, and HPC applications. The focus is on revising data-path structures of computing techniques and conceiving new processing architectures that maximize the advantages of using configurable devices.

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