Call for applications – PhD candidate

Lyon Institute of Nanotechnology http://inl.cnrs.fr
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PUF design using emerging ferroelectric technologies.

Scientific context:

Emerging technologies such as ferroelectric capacitors (FeCap) and transistors (FeFET, FemFET) are among the best technological options to overcome the bottleneck of classical computing architectures. Indeed, the main advantage of non-volatile emerging technologies lies in the possibility to change the computing paradigm, i.e. perform computing directly inside the memory or the computing unit's embedded memory. This allows a drastic reduction of data transfers thus increasing both the energy efficiency and the computation speed.

The promises in terms of energy and computing efficiency make these technologies extremely appealing for Internet of Things and embedded artificial intelligence applications. For both applications, high security level is mandatory to protect personal data and intellectual property of used devices. Physical Unclonable Functions (PUF) is today a hardware security primitive which can be used for both requirements. A PUF is a hardware unit capable of leveraging the manufacturing process variability that inevitably occurs during the fabrication of integrated circuit. In consequence, PUFs can be used to create a unique IC (Integrated Circuit) identifier of but also cryptographic keys under certain conditions.

Thesis objectives:

The main objective of this thesis is to develop a new PUF based on Ferroelectric technologies and evaluate it according to the state of the art both in terms of quality and security attack.

In addition, PUF design are often close to True Random Number Generator (TRNG) because of noise extraction. Indeed, when a PUF try to extract static noise (manufacturing variations), TRNG extract random noise (electronic noise, thermal noise, jitter, …). Another objective of this thesis will be to study the possibility to create a dual PUF/TRNG structure.

Finally, the hardware security primitive will have to be tested and evaluated.

Mots-clefs:

Physical unclonable function, Ferroelectric technologies, FeFET, FemFET, compact model, hardware security, TRNG

Profile:

The candidate will have a strong background in topics related to the following area:

- Experience in micro-electronic circuit design and modelling.
- Software and languages under consideration of the computation, simulation, and hardware design: Cadence, VHDL, Verilog, C/C++, Python.
- Knowledge basic functions in hardware security (PUF, TRNG, …) will be also appreciated.
- Knowledge in statistical evaluation will be appreciated.
- The candidate should be curious, highly motivated, and flexible to address a highly inter-disciplinary project.
- Good English skills, writing and speaking, are needed.

About INL and the Electronic research team:

The Institute of Nanotechnologies of Lyon (INL) is a Joint Research Unit (UMR 5270) whose supervisory entities are CNRS, ECL, INSA, Lyon 1 University, and CPE Lyon. The INL's mission is to develop multidisciplinary technological research in the field of micro and nanotechnologies and their applications. The conducted research extends from materials to systems, and the laboratory relies on the Lyon-based NanoLyon technological platform. The areas of application cover major economic sectors: the semiconductor industry, information technologies, life and health technologies, energy, and the environment.
The laboratory is multi-site with locations on the Ecully and Lyon-Tech La Doua campuses. It brings together around 200 people, including 121 permanent staff. The INL is a major player in the Research and Education Cluster.

The main objective of the electronics department is to develop technologies, devices and systems for specific applications. New technologies are explored using top-down and bottom-up approaches for the demonstration of advanced nanoelectronic devices and circuits. New design methodologies and tools are also developed in the frame of our activities. Thanks to the collaborations of the device and design teams of the electronics department with other groups at INL in the Materials, Photonics and Biotech departments, we have focused our research activities on heterogeneous circuits for biotechnologies and electronic systems for health.

Send CV and statement of purpose (in English or French) to

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