IMM Institute for Microelectronics and Microsystems
Consiglio Nazionale delle Ricerche

AGRATE UNIT

The Institute for Microelectronics and Microsystems of the National Research Council (CNR)

opens 2 Post-Docs Positions

funded by project ***COSMO*** within the National PRIN program

Analogue Computing with Dynamic Switching Memristor Oscillators: Theory, Devices and Applications

Project description.

The overall objective of the ***COSMO*** project (January 27th, 2020 - January 26th, 2022) is to lay the foundations and to provide a small scale demonstration of an alternative parallel and analogue computational architecture relying on the collective activation of interacting memristive oscillators.

Conventional computing, based on classical Von Neumann architectures, is now struggling with tasks like face recognition, real-time navigation control, object segmentation and depth perception. Such computational problems require a rethinking of the overall computing architecture that exploits emerging technologies for storage and memory. The memristor (memory + resistor), a two-terminal metal/insulator/metal device able to change its resistance upon electric stimulation, is one of the main proposed candidates to implement a parallel computing architecture mixing memory and computation. The highly nonlinear dynamics of a memristive device can be exploited to build nanoscale oscillators. In the approach of computing with physics, networks of interconnected and interacting oscillators can develop cooperative and collective dynamics, e.g. phase synchronization and other self-organizing spatio-temporal phenomena useful to alternative computing schemes overpassing the limits of conventional digital and Boolean computation.

The project gathers the competencies of 4 Italian partners in the fields of material science/device physics, dynamical systems and control theory.

Open Position description.

Within the ***COSMO*** project, **the group at CNR-IMM, Unit of Agrate Brianza (Italy)** (www.mdm.imm.cnr.it) will set up the entire production chain from (*i*) the development of novel memristive device technologies; (*ii*) to the realization of compact oscillators combining memristive and conventional electronic components and (*iii*) up to the arrangement of small networks of oscillators. We are going to open 2 post- doc positions under the scientific supervision of Dr. Stefano Brivio.

Position A: *Development of novel hardware technologies useful for compact oscillator units*. The focus will be the development of volatile memory and memristive devices and the realization of compact oscillators and small oscillator networks. The activity will include both device fabrication (using the local clean room facilities) and electrical testing at the CNR-IMM. The activity will be in continuous, bi-directional interconnection with the modeling/simulation work.

Position B. *Physics-based simulation of memristive devices, oscillators and small networks***.** The focus will be the development of multi-physics-based dynamic models involving ion migration, redox-reactions and phase transitions. Compact versions of the models will be used to simulate circuit networks comprising a limited number of oscillators. The activity will be in continuous, bi-directional interconnection with the experimental work.

Additional Information and specific requirements for the open positions

Institution: CNR-IMM, Unit of Agrate Brianza, Italy
Level: PhD degree
Contract: 1 years, renewable to 3 (project duration)
Salary: 28000-30000 €/year (gross)
Fields: Physics, Electrical Engineering, Computer Engineering, Material Science

Application: through public selection, which will be posted soon on the CNR web site. Interested candidates can send an e-mail with a CV to the following contact for further information. The planned starting dates for both positions are within the first months of 2020 (February – May 2020), depending on candidate availability and required time for selection procedures.

Contact: Stefano Brivio, CNR-IMM-Agrate Brianza, stefano.brivio@mdm.imm.cnr.it

Specific requirements for the open positions

Position A. PhD in Physics, Electronic Engineering, Material Science or any related disciplines to the project topics. Proven experience in the device fabrication and advanced electrical testing of emerging devices and memories. Experience with clean room facilities.

Position B. PhD in Physics, Electronic Engineering, Material Science or any related disciplines to the project topics. Proven experience in finite-element modeling of physics processes, physics-based modeling of devices possibly with emphasis in memory, RRAM and memristive devices.