POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 41st cycle

Research Area n. 2 - Electronics

INTERDISCIPLINARY Research Field: LOW-ENERGY IN-SENSOR COMPUTING CONCEPTS FOR MEMS WITH AUTONOMOUS CALIBRATION

Monthly net income of PhDscholarship (max 36 months)
1400.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "**STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING**". See https://www.dottorato.polimi.it/?id=422&L=1 for further information. (italiano) Nel processo produttivo di microsistemi MEMS, particolare attenzione viene oggi riservata a ridurre la complessità del processo di calibrazione, sia in termini di tempo che di risorse richieste dal processo. Partendo da questo fondamentale presupposto, l'attività prevista nella ricerca mira a sviluppare innovativi schemi e circuiti di auto-calibrazione (o calibrazione in continuo) a bordo del MEMS, attraverso il design di algoritmi e circuiti di edge computing caratterizzate da ridotti consumi energetici. (inglese) During the productive process of MEMS microsystems, the calibration process should be made as simple as possible, in terms of reducing both the required time and the overall resources. Based on this concept, the the research activity aims at developing innovative schemes and circuits for self-calibration (or continuous-time calibration) embedded in MEMS, through the design

	of algorithms and circuits for edge computing characterized by reduced energy consumption.
Methods and techniques that will be developed and used to carry out the research	(italiano) Verranno utilizzate tecniche di data assimilation (e.g., extended o ensemble Kalman filters) accoppiate a metodi di model discovery (e.g. sparse identification of nonlinear dynamics). Tali tecniche di auto-calibrazione verranno implementate in hardware mediante circuiti capaci di calcolo in memoria (in-memory computing) caratterizzati da alto parallelismo, alta efficienza energetica e capacità di riconfigurabilità e adattamento. (inglese) The methodology relies on techniques for data assimilation (e.g., extended or ensemble Kalman filters) coupled with methods of model discovery (e.g. sparse identification of nonlinear dynamics). These self-calibration techniques will be implemented in hardware via circuits capable of in-memory computing characterized by high parallelism, high energy efficiency and ability for reconfiguration and adaptation.
Educational objectives	The educational objectives include the acquisition and consolidation of knowledge and practical skills on circuit design, characterization and simulation.
Job opportunities	The PhD program provides a solid background for covering several professional engineering jobs in the industry, including microelectronics process experts and designers of embedded system and sensors.
Composition of the research group	2 Full Professors 0 Associated Professors 6 Assistant Professors 8 PhD Students
Name of the research directors	Prof. Daniele Ielmini

Contacts
daniele.ielmini@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--

Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences).

TEACHING ASSISTANTSHIP: availability of funding in recognition of supporting teaching activities by the PhD student
There are various forms of financial aid for activities of support to the teaching practice.
The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY:
1st year: Yes
2nd year: Yes
3rd year: Yes

DESK AVAILABILITY:
1st year: Yes
2nd year: Yes
3rd year: Yes

Premiality

Premialities will be recognized to the PhD candidate.

Up to 1200 euro (gross amount) after the completion of the 1st year;
up to 1800 euro (gross amount) after the completion of the 2nd year;
Up to 2400 euro (gross amount) after the completion of the 3rd year.

The premialities will be assigned provided that she/he demonstrates a significant contribution to the growth of scientific excellence, the industrial valorization of research, the networking and communication activities of the Department.