POLITECNICO DI MILANO

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

## Research Area n. 2 - Electronics

## THEMATIC Research Field: NOVEL READOUT CIRCUITS FOR DETECTOR APPLICATIONS IN NON-CONVENTIONAL ENVIRONMENTS

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

| Context of the research activity | |
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| **Motivation and objectives of the research in this field** | In fundamental and applied research (physics experiments, space observations, medical imaging...) key challenges are posed to the design of new detectors and associated electronics, such as ultra-low noise, power consumption, background environment, temperature of operation, etc… This research is specifically devoted to the design of novel front-end electronics for some reference applications where the use of CMOS technology is one side mandatory (readout compactness, number of channels) but on the other side introduces design challenges, especially where technology scaling enhances digital performances but may impose limitations to the analog design. |
| **Methods and techniques that will be developed and used to carry out the research** | The principal working method will be the analog design of low-noise analog integrated circuits (mainly pre-amplifiers) supported by simulations allowing the comparison and optimization of different circuit topologies, addressing several challenges such as low-noise, low-power operation, low background and low crosstalk in multichannel realizations. Transistor models, also at low temperature, in different CMOS technologies will be carefully studied to select the optimal trade-offs. The study of the circuit non-ideal behavior will be a crucial point of the work. Finally, the combination of the analog |

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| | front-end with the back-end will be also addressed, comparing analog vs. digital realization of the processing blocks. |
| **Educational objectives** | The education objectives include: 1) strengthening a vertical knowledge on analog microelectronics in the domain of detectors readout, 2) improving autonomy and time management, and project leadership skills along with 3) developing soft skills including writing scientific publications, public speaking at conferences and collaboration with international project partners. |
| **Job opportunities** | Microelectronics design skills are highly requested by companies, in particular large semiconductor corporations and design centers. Moreover, expertise in sensors and readout electronics, as well as their combination with machine learning for signal processing, are pivotal for a large range of industrial applications, offering several job opportunities. |
| **Composition of the research group** | 1 Full Professors<br>2 Associated Professors<br>0 Assistant Professors<br>15 PhD Students |
| **Name of the research directors** | Proff. Marco Carminati, Carlo Fiorini |

| **Contacts** |
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| marco1.carminati@polimi.it<br>Phone: +39.02.2399.6102 |

| **Additional support - Financial aid per PhD student per year (gross amount)** | |
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| **Housing - Foreign Students** | -- |
| **Housing - Out-of-town residents** | -- |

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

| **Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information** |
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| EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, |

funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student.

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