



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 38th cycle

Research Area n. 1 - Computer Science and Engineering

**PNRR_352 Research Field: METHODOLOGIES FOR AUTOMOTIVE MULTIPROCESSOR
SYSTEM-ON-CHIP DESIGN SPACE EXPLORATION**

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

Nowadays, Multi-processors Systems-on-Chip (MPSoCs) represent the de facto standard for both embedded and general-purpose architectures. In particular, heterogeneous MPSoCs are becoming the dominant computing paradigm for the automotive domain; indeed, given their cost-effectiveness and scalability, they are increasingly used to replace hundreds of discrete and independently operated ECUs and to optimize communication among subsystems in modern automotive vehicles.

The MPSoCs paradigm promises to provide the best compromise in terms of a stable hardware platform which is software programmable, thus customizable, upgradable and extensible. However, given the significant market volumes of the automotive domain, it is of utmost importance that the architecture is optimized by evaluating the tradeoffs between performance, area and power consumption by taking into account the constraints imposed by the automotive domain. In this scenario, the main goal of the PhD research is to define an innovative design methodology for system-level modeling and design space exploration (DSE) to achieve the above tradeoffs by identifying suitable architectural configurations in terms of the on-chip interconnection network and memory hierarchy.



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| Methods and techniques that will be developed and used to carry out the research | <ul style="list-style-type: none"> - System-level modeling techniques to evaluate various metrics associated with a system configuration, among which performance, area and power consumption. These models will range from simulation-based ones to - machine-learning models. - An efficient design space exploration methodology to evaluate design tradeoffs and tune automotive MPSoC platforms w.r.t. the above metrics. |
| Educational objectives | <p>To acquire and/or consolidate knowledge and/or practical skills around:</p> <ul style="list-style-type: none"> - Modeling and simulation at the system-on-chip level - Hardware architectural definition and exploration - Design of experiments and Machine-Learning models |
| Job opportunities | The research proposal addresses an output profile to respond to the needs of the research and design sector of edge and IoT systems, which requires technical experts with highly interdisciplinary skills and in-depth knowledge in the following areas: (i) mathematical / statistical modeling, (ii) design of high-performance parallel computing and data analysis applications for edge and IoT systems (iii) design of accelerators for the Deep Learning sector. |
| Composition of the research group | 1 Full Professors 2 Associated Professors 2 Assistant Professors 2 PhD Students |
| Name of the research directors | Cristina Silvano |

| Contacts |
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| cristina.silvano@polimi.it; +39 02 2399 3692; https://silvano.faculty.polimi.it |

| Additional support - Financial aid per PhD student per year (gross amount) | |
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| Housing - Foreign Students | -- |
| Housing - Out-of-town residents (more than 80Km out of Milano) | -- |



(more than 80Km out of Milano)

Scholarship Increase for a period abroad

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| Amount monthly | 700.0 € |
| By number of months | 6 |

National Operational Program for Research and Innovation

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| Company where the candidate will attend the stage (name and brief description) | STMicroelectronics Italia |
| By number of months at the company | 6 |
| Institution or company where the candidate will spend the period abroad (name and brief description) | ETH Zurich |
| By number of months abroad | 6 |

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

Attinenza alla tematiche, alle missioni/componenti prescelte del bando PNRR v. D.M. 352, art.6

The research activities addressed by this proposal are perfectly in line with the "vision" of the National Recovery and Resilience Plan (PNRR) as part of Mission 1: "Digitalization, innovation, competitiveness, culture and tourism" with emphasis on the component M1C2: "Digitalization, innovation and competitiveness in the production system". In particular, we refer to Transition 4.0, aimed at empowering the digital transition of businesses and to the rate of innovation of the industrial and entrepreneurial fabric of the country. The system-level design methodologies techniques of embedded high-performance multicore devices might represent a significant contribution to several application domains, such as automotive, aeronautics and aerospace and more in general microelectronic devices for mobile and real-time systems. Moreover, system-level design methodologies techniques of embedded high-performance multicore devices will reinforce a synergistic research method between university and industry and it will help to sustain the processes for innovation and technology transfer as well as the competences to support innovation.

Impresa, presso cui si svolgerà l'attività esterna

STMicroelectronics Italia, Automotive Division.

Ente, università, azienda, centro di ricerca presso cui si svolgerà il periodo di studio e ricerca all'estero.

Microarchitetural research group at ETH Zurich.

All information regarding educational activities, personal funding, regulations and obligations of Ph.D. candidates are available on the



web site <https://dottoratoit.deib.polimi.it/>