POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 40th cycle

Research Area n. 1 - Computer Science and Engineering

THEMATIC Research Field: QUANTUM SOFTWARE ENGINEERING

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	Quantum computing is reaching significant and promising advancements and represents one of the ground-breaking initiatives that are expected to change the way we conceive programming today. Recently, such kind of computing has become more accessible thanks to services providing access to quantum hardware on the cloud, igniting a renewed interest for the field in researchers, businesses and programmers. While this has provided technical advancements in the discipline, it also highlighted the lack of quantum software engineering tools and methodologies available to support the steps in the lifecycle of quantum software, such as design, implementation, testing and maintenance, creating an enormous obstacle in harnessing the full capabilities of a quantum computer. This is further exacerbated by the distinct types of available quantum computing models, such as quantum annealers, measurement-based and gate- based models, which complicates the development of supporting approaches as they might not be compatible with each model. The focus of this research is thus to provide understandable and effective tools and methodologies to support the development of safe and reliable quantum software and assist programmers during the process by supplying them with helpful guidelines, metrics and design abstractions, such that new quantum software development is not stifled by the field complexity.

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Methods and techniques that will be developed and used to carry out the research	The work will be highly experimental and will include: - the development of programming examples to derive lessons learnt; - the definition of proper solutions addressing specific problems and their validation in multiple cases to demonstrate their generality; - the practical implementation of the identified solutions in specific toolsets and frameworks supporting the work by quantum software engineers; The research will be mainly carried out at Politecnico di Milano, but visits to other internationally recognized research centers will be pursued.
Educational objectives	- Learn about the research methods (both experimental and theoretical) adopted in software engineering - Learn about quantum computing - Advance the state of the art on approaches to simplify the engineering of quantum computing programs and to increase their quality - Learn how to conduct a case study-based evaluation - Learn how to write scientific papers in the area of software engineering
Job opportunities	Considering the significant interest quantum computing is raising and the need to have people able to develop software according to this paradigm, we expect PhD graduates in this area to be very successful in finding multiple job opportunities both in industry and academia
Composition of the research group	8 Full Professors 3 Associated Professors 2 Assistant Professors 14 PhD Students
Name of the research directors	Prof.ssa Elisabetta Di Nitto

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)

Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

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): financial aid per PhD student (5.707,20 Euro per 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: individual use
2nd year: individual use
3rd year: individual use