



PhD in MODELLI E METODI MATEMATICI PER L'INGEGNERIA / MATHEMATICAL MODELS AND METHODS IN ENGINEERING - 40th cycle

THEMATIC Research Field: COMPUTATIONAL TECHNIQUES FOR OPTICAL PROCESSING

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

The emergence of optical computing offers a paradigm shift in high-performance computing, leveraging the speed and energy efficiency of photonic processors for tasks such as numerical simulation, optimization, and machine learning. However, traditional algorithms are designed for electronic architectures and must be adapted or rethought to fully exploit the capabilities of optical hardware. This research aims to develop and analyze novel computational techniques tailored for optical processing, addressing challenges in solving algebraic systems, differential equations, and AI-related tasks.

Methods and techniques that will be developed and used to carry out the research

The research will focus on designing and optimizing algorithms for optical processors, incorporating principles from Numerical Analysis, Scientific Computing, and Machine Learning. The study might also explore hybrid approaches, integrating optical and electronic computing for enhanced performance. This activity is part of an ongoing collaboration between the Department of Mathematics (Politecnico di Milano) and Rebel Dynamics S.r.l.

Educational objectives

The candidate will gain expertise in advanced numerical methods, high-performance computing, and optical processing technologies. They will develop skills in algorithm design, computational modeling, and interdisciplinary research, fostering collaborations with



	interdisciplinary research, fostering collaborations with both academic and industrial partners.
Job opportunities	Graduates will be well-equipped for careers in academia, research institutions, and industries requiring advanced computational techniques. The skills developed - numerical modeling, algorithm design, and high-performance computing - are highly transferable, opening opportunities in sectors such as engineering, finance, and AI.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Alessio Fumagalli, Prof. Francesco Regazzoni

Contacts	
Alessio Fumagalli: alessio.fumagalli@polimi.it Francesco Regazzoni: francesco.regazzoni@polimi.it MOX - Modeling and Scientific Computing - Department of Mathematics - Politecnico di Milano - Office: Building 14 - via Bonardi 9, 20133 Milano, Italy	

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, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year 1st year: max 1.902,40 euros 2nd year: max 1.902,40 euros 3rd year: max 1.902,40 euros The PhD students are encouraged to take part in activities related to teaching, within the limits allowed by the regulations.



Access to 1 individual PC per student and a high-performance cluster is granted.

The cluster features 40 CPU nodes and one GPU node. Each CPU node is powered by two 24-core CPUs with 512 GB RAM.

The GPU node includes two 16-core CPUs with 512 GB RAM, and three GPUs, each possessing 64 GB of memory.

Moreover, 1 individual desk per student is granted.