The Birth of the Master in HPC Engineering at Politecnico di Milano

Author: Gianluca Palermo

Institution: Politecnico di Milano

Short author bio – Full Professor at Politecnico di Milano, Department of Electronics, Information and Bioengineering. His research expertise spans various fields, including system-level and low-power design, application autotuning, and molecular docking, with a strong focus on high-performance computing (HPC) applications for drug discovery.

High Performance Computing (HPC) has rapidly become one of the key enabling technologies for science, industry, and society at large. From climate modelling, drug discovery, and artificial intelligence to aerospace engineering and quantum computing, HPC is transforming the way we tackle the most complex challenges of our time. Recognizing this shift, Politecnico di Milano launched a brand-new Master's program in HPC Engineering in 2022. This academic initiative has grown at an impressive pace since its launch.

Overview

The High-Performance Computing Engineering program at Politecnico di Milano emerged as a spin-off of two strong subject areas: Computer Science and Engineering, and Mathematical Engineering. Yet its DNA has always been multidisciplinary. In addition to those who naturally progress onto the program, students from physics, automation, aerospace, electronics, energy, and mechanical engineering are also drawn to it, bringing a diversity of perspectives and skills.

The numbers tell the story of its success: the program began in the 2022/23 academic year with around 40 students already enrolled. Just a few years later, in the current 2025/26 academic year, enrolment had grown to over 115 students, a threefold increase that highlights the demand for HPC expertise and the enthusiasm for the program.

ACHIEVE project is developed and delivered under European Union's Digital Europe Programme Project no. 101190015

Co-funded by the European Union

The program was designed with the clear mission to prepare students for careers in HPC Engineering, with a focus on:

- Designing massively parallel applications for high-performance systems;
- Mathematical and statistical modelling of complex problems and systems;
- Design and optimization of accelerators for supercomputing;
- Algorithms and applications for Quantum Computing

This combination of skills equips graduates to tackle both today's HPC challenges and tomorrow's disruptive technologies.

A European Dimension: From EUMaster4HPC to ACHIEVE

The birth of the Master was not an isolated initiative. It was inspired and supported by the EUMaster4HPC project, funded by the EuroHPC Joint Undertaking, whose goal was to "implement the first pan-European High Performance Computing Master programme". Politecnico di Milano took that momentum and developed its own local Master, ensuring alignment with European efforts while tailoring the program to its strengths. This European dimension remains central: the Master has recently linked with ACHIEVE, a new pan-European Master on Cloud and HPC infrastructures, funded by the Digital Europe Programme and coordinated by EIT Digital, with an added focus on innovation and entrepreneurship.

Voices from Inside the Master in HPC

To better understand the motivations behind the programme and its unique features, I would also like to share insights gained from conversations with some of the key people who supported its creation from different perspectives.

According to Prof. Cristina Silvano, the strength of the program lies precisely in its multidisciplinary nature*: "We identified a clear need for a structured program combining computer science and engineering with mathematical modeling and the demands of high-performance computing. What makes this program unique and highly attractive, both for students and industry, is its integration of mathematics, informatics, physics, and engineering disciplines."*

A key element of the curriculum is the emphasis on mathematical and statistical modeling, as highlighted by Prof. Anna Paganoni: *"HPC is not just about raw computing power; it is about accurately modeling real-world problems. Mathematics enables students to design*

efficient and reliable algorithms. We provide them with the tools to merge their engineering background with quantitative reasoning, making them stronger HPC professionals."

The program also looks to the future by including courses in Quantum Computing. As Prof. Paolo Cremonesi explains: *"The students graduating today will be the professionals leading quantum applications tomorrow. It is crucial to expose them early to quantum paradigms, so they can understand the continuum between classical HPC and quantum acceleration. This field becomes a true playground for innovation."*

Finally, Dott. Federico Schiepatti's role as program manager has been essential in keeping the initiative cohesive and connected at a European level: *"My responsibility has been to ensure that students feel supported while also linking Politecnico's Master with broader European initiatives such as EUMaster4HPC and ACHIEVE. Students see this program as something special, thanks to the openness of the faculty and the European dimension that makes them feel part of something larger than a single university."*

The Students' Enthusiasm

What truly sets the program apart is how it is perceived by the students themselves. Luca Muscarnera, a student from the first cohort, described his experience as follows: *"This Master's brings together engineering with mathematics applied to computational problems, computer science, and system architectures. For me, it wasn't a compromise; it was exactly the program I was looking for."*

To further illustrate the reported enthusiasm, the image below shows some of the HPC Engineering students who attended the latest EuroHPC Summit 2025 in Krakow. In addition to the EUMaster4HPC students who were invited by the organizers to act as volunteers, the group included over 40 Politecnico di Milano students who chose to attend the summit, excited to experience the flagship EuroHPC event and immerse themselves in the wider European HPC community.

Conclusions

The Master's in High-Performance Computing Engineering at Politecnico di Milano has already demonstrated its value through strong student growth, multidisciplinarity, and alignment with Europe's HPC strategy. But the journey has only just begun. With quantum technologies, AI-driven applications, and new accelerator architectures on the horizon, the program is set to remain a breeding ground for the next generation of HPC engineers.

The ACHIEVE project is part of the game and contributes to the program not only with its European dimension, but also with its innovation and entrepreneurship flavor.

More info about the program at Politecnico di Milano can be found at https://masterhpc.polimi.it/en/

ACHIEVE project is developed and delivered under European Union's Digital Europe Programme Project no. 101190015

Co-funded by the European Union