

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

THEMATIC Research Field: BIOINSPIRED UNDERWATER PROPULSION FOR ULTRA-LOW NOISE AUV

Monthly net income of PhDscholarship (max 36 months)

1500.0

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	Autonomous Underwater Vehicles (AUVs) are increasingly deployed in applications requiring minimal acoustic signatures, such as marine biology studies, underwater surveillance, and environmental monitoring. Conventional propulsion systems, however, often produce significant hydrodynamic noise and turbulence, limiting stealth and efficiency. Nature offers elegant solutions: fish, cephalopods, and other marine organisms exhibit propulsion mechanisms that are both silent and efficient, evolved through millions of years of adaptation. This research aims to explore and develop bioinspired underwater propulsion systems that significantly reduce noise while maintaining or improving maneuverability and endurance. The objective is to understand the principles of biological propulsion — including fin-based swimming, undulatory motion, and pulsatile jetting — and translate them into viable engineering designs for AUVs.Key goals include the development of low-noise propulsion prototypes, modeling and simulation of bioinspired thrust mechanisms, and experimental validation in controlled environments. The project will also investigate materials and actuation strategies suitable for soft or compliant structures. Ultimately, the research aspires to contribute to a new class of quiet, agile, and energy-efficient AUVs for sensitive underwater operations.
Methods and techniques that will be developed and used to carry out the research	Autonomous Underwater Vehicles (AUVs) are increasingly deployed in applications requiring minimal



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Educational objectives	The primary educational objective of this PhD project is to train a highly skilled researcher at the intersection of bioinspired engineering, underwater robotics, and advanced fluid dynamics. The candidate will develop deep knowledge of biological propulsion principles and their translation into robotic systems, gaining expertise in both theoretical modeling and experimental validation.The program will provide hands-on experience in computational methods (CFD, FEM), soft robotics fabrication techniques, sensor integration, and real-time control systems. The candidate will also build strong capabilities in system-level design, performance optimization, and interdisciplinary problem-solving.The project will encourage innovation and creativity, preparing the candidate for future roles in academia, industry, or applied R&D in underwater technologies.

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	The multidisciplinary nature of the training – combining fluid dynamics, mechatronics, control systems, and biomimicry — ensures broad and flexible employability across research institutions and innovative technology firms worldwide: graduates will be well-prepared for research and development roles in autonomous underwater vehicles (AUVs), marine robotics, or stealth technologies for defense and environmental monitoring. Opportunities also include positions in soft robotics, biomimetic system design, and energy-efficient propulsion development. Moreover, the growing focus on sustainable and quiet underwater technologies also creates demand
Job opportunities	in emerging sectors such as blue economy startups, naval research centers, and marine exploration
	are active in research areas closely aligned with this
	project. The Massachusetts Institute of Technology (MIT)
	robotics and biomimetic propulsion, particularly through its
	Sea Grant AUV Lab. Stanford University is well known for
	its work in soft robotics and bioinspired manipulation. In
	interdisciplinary programs in robotics and fluid mechanics.
	while the University of Cambridge in the UK is prominent
	in bioinspired engineering and marine robotics.
Composition of the research group	2 Full Professors 1 Associated Professors 0 Assistant Professors 2 PhD Students
Name of the research directors	Prof. F. Braghin, Ing. G. Bianchi

Contacts

For questions about scholarship/support Francesco.braghin@polimi.it, giovanni.bianchi@polimi.it, phd-dmec@polimi.it

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

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Amount monthly	750.0 €
By number of months	6

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

Financial aid is available for all PhD candidates (purchase of study books and materials, funding for participation in courses, summer schools, workshops and conferences) for a total amount of € 6.114,50. Our candidates are strongly encouraged to spend a research period abroad, joining high-level research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 750 euro/month - net amount). Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD candidate. 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.