



PhD in MODELLI E METODI MATEMATICI PER L'INGEGNERIA / MATHEMATICAL MODELS AND METHODS IN ENGINEERING - 39th cycle

**THEMATIC Research Field: ADVANCED MODELING OF IONIC PROPULSION FOR
ATMOSPHERIC FLIGHT**

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 Ph.D. research activity is part of the Iprop Project funded by an European Innovation Council grant. The project aims to develop innovative ionic propulsion systems for flying vehicles by means of joint theoretical, numerical and experimental studies. The Iprop project is lead by Politecnico di Milano and the other members are University of Bologna (Italy), Aeronord sas (Italy), Karlsruher Institut für Technologie (Germany), Technische Universität Dresden (Germany), von Karman Institute for Fluid Dynamics (Belgium), Isae Supareo (France), CNRS (France). Further info can be found at the link: <https://pat.polimi.it/iprop-project>

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

Ionic propulsion is based on plasma corona discharge. An imposed electric field ionizes the air, mainly by electron impact. The generated positive heavy ions are accelerated by the electric field and transfer momentum to air neutral molecules, thus generating thrust. The Ph.D. project will focus on theoretical and numerical modeling of the corona discharge. Air ionization will be studied coupling together an enhanced drift diffusion continuum model and a collisional Particle in Cell (PIC) method. Momentum transfer will be modeled by a suitable combination of drift diffusion and Navier-Stokes equations. The numerical solution of the above physico-chemical models will be implemented in the high



	performance library deal.II (www.dealii.org). The Ph.D. student will regularly collaborate with the other participants of the Iprop consortium.
Educational objectives	The Ph.D. program in Mathematical Models and Methods in Engineering trains students in advanced areas of applied mathematics. Ph.D. candidates are expected to go thoroughly both into modelling and methodological aspects of applied mathematics. Further information is available at: www.mate.polimi.it/dottorato/?cn-reloaded=1
Job opportunities	Expected professional placements for Ph.D. doctors are: academic research in Italian or International Universities and Research Institutions, R & D divisions of private companies, study and research centers of public Agencies, financial and insurance Institutions.
Composition of the research group	0 Full Professors 4 Associated Professors 3 Assistant Professors 5 PhD Students
Name of the research directors	Paolo Barbante, Carlo de Falco, Lorenzo Valdetaro

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, 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. 1 individual PC per student + several shared PC. Access to one cluster with 32 processors and 384 GB RAM, and to several multi-processor servers.