



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 37th cycle

THEMATIC Research Field: TECHNOLOGIES FOR INNOVATIVE COOLING SYSTEMS

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

Air Conditioning systems are playing a crucial role in future energy demand and global emissions. Using air conditioners and electric fans to stay cool accounts for nearly 20% of the total electricity used in buildings around the world today. This trend is set to grow as the average ambient temperature are raising and due to demographic growth of hotter countries. According to a recent report of International Energy Agency (IEA) the energy demand from air conditioners will more than triple by 2050. In this contest, it is important to explore new technological solutions that can match with a more sustainable pathway. At the state of the art, Portable Air Conditioners (PAC) are characterized by a compact cooling system (about 3kW Cooling Capacity) equipped with a discharge tube to release the exhaust hot air to the external environment. This product configuration is not the most efficient since it is penalized by the external air infiltration resulting from negative pressure generated during the operations. The objective of this research is to define a potential new product configuration by splitting the low and high pressure sides between the internal and external and enabling new product design by miniaturizing the evaporative cooling system which will be installed inside the home. The research will focus on the design of new heat exchangers and fan motors able to guarantee the cooling performances as today but with significant size reduction. Main activities of the project include:



	<ul style="list-style-type: none"> • Characterization and modeling of the current cooling system • Model validation by means of dedicated experimental data collected • Design of new evaporating system exploring: micro channels heat exchangers, compact fan motors, new refrigerants and any other new component contributing to achieve the objective • Prototyping the new cooling system design and test it in order to validate the performances.
Methods and techniques that will be developed and used to carry out the research	<p>This Ph.D. project aims to develop a domestic air conditioner based on innovative design. The activities are based on numerical modeling of heat transfer and thermodynamic cycle suitable to improve the sustainability of these products. It is requested to acquire competences in using CFD tools and process tools. The activity includes an internship in an industrial company dealing with the production of air conditioning systems for civil and industrial application. In this period skills in the management of experimental tests will be acquired</p>
Educational objectives	<p>Educational objectives consist in the developing of modelling tools to enhance scientific understanding of heat transfer for heat exchanger design. Literature review and model validation on experimental data strengthen the prediction capability of the results. It is expected the development of competences in the field of experimental measurements.</p>
Job opportunities	<p>Job opportunities for a successful Ph.D candidate include both industrial and academical research or specific job positions as Cooling System engineer a job profile that is highly valued in the current Job Market</p>
Composition of the research group	<p>1 Full Professors 3 Associated Professors 3 Assistant Professors 2 PhD Students</p>
Name of the research directors	<p>Fabio Inzoli - Stefano De Antonellis</p>



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	566.36 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. The amount is about Euro 3.000,00.</p> <p>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.</p> <p>Computer availability: individual use.</p> <p>Desk availability: individual use.</p> <p>Awards: Awards will be recognized to the PhD candidate up to Euro 1.500,00 (gross amount, after completion of the 3rd year). More details about this program will be provided by PhD Program Steering Committee.</p>