



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

**PNRR_352 Research Field: DYNAMIC BEHAVIOUR OF THE ROTATING MACHINERY FOR
POWER GENERATION IN STEADY STATE AND TRANSIENT CONDITIONS**

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 proposed research focuses on mission M2C2 ENERGIA RINNOVABILE, IDROGENO, RETE E MOBILITÀ SOSTENIBILE of the PNRR. Starting from the 21th UN Climate Change Conference of Parties (COP21), hosted in Paris in 2015, world leaders committed to step up the efforts to contrast the impacts of climate change and to invest resources consistently with a pathway towards low greenhouse gas emissions and climate-resilient development. This implies also a more efficient way to product electrical power, both by using renewable energies and by improving the efficiency of the traditional plants. It is undeniable that energy transition will require the support of traditional power plants when, for example, other forms of energy (sun, wind) are not available. This requires very quick starts and stops for the machines used in traditional power plants and makes maintenance interventions more frequent. Moreover, the use of green fuels, like hydrogen, or renewable energies, like geothermal, sets new challenges for the units installed in the already existing power plants. The use of green fuels and the increase in the efficiency of the power units generally involves technical solutions that can determine the emergence of dynamic instabilities, both during the starting and stopping transients, which will become much more frequent, and during operation, fully operational.



	<p>From a technological point of view, the most immediate and least invasive intervention is on the support bearings which must guarantee large margins of stability. It is therefore essential to have reliable models to predict and guarantee smooth operation in the long term even in an energy transition scenario in which the power units are not used in their original design conditions.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>To carry out this research the following methods and techniques will be developed: an accurate model of the oil-film bearings, of the different types, that are installed on AEN turbine and generators will be established; the model will be validated on the test rigs available at the dept. of Mechanical Engineering of Politecnico di Milano, after suitable modifications; the developed model will be used to analyse the behaviour of turbines and generators in steady-state and in transient operations, especially to evaluate instability effects; the results obtained will be compared and the model tune-up, if necessary, with the experimental evidences coming from the fleet of the units installed by AEN worldwide.</p>
<p>Educational objectives</p>	<p>The educational objectives of the research are the acquisition of the advanced theoretical knowledge and empirical skills for the development of accurate modelling of oil-film bearings, implementing the most sophisticated numerical models and experimental techniques, exploiting the availability of high-end test-rigs. This would include newly developed data analytics, models and simulation tools for use in the design and operation of gas and steam turbines and generators, independently from the thermodynamic cycle and the fuel used. With the advent of new technologies and services, this program presents the latest developments that are better leveraged to improve system performance.</p>
<p>Job opportunities</p>	<p>Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared to Master of Science holders in the same field.</p>
<p>Composition of the research group</p>	<p>1 Full Professors</p>



	2 Associated Professors 1 Assistant Professors 6 PhD Students
Name of the research directors	Prof. Paolo Pennacchi

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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

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Ansaldo Energia S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Texas A&M University
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information	
<p>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 euro 5.707, 13.</p> <p>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.</p>	