



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

**THEMATIC Research Field: DESIGN OF SPECIAL COMPONENTS IN ROTATING MACHINES
FOR ENERGY TRANSITION**

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	
<p>Motivation and objectives of the research in this field</p>	<p>The development of rotating machines for the energy transition requires a new approach to design, aimed at a priori verification of stability, given the lack of existing references and the fact that - probably in the medium term - all machines will be one of a kind. In particular, the use of working fluids, now generally considered as unconventional, such as hydrogen, carbon dioxide, organic fluids, requires the use of particularly effective seals, also for performance purposes, and, sometimes, of bearings that use the same working fluid. Regarding seals, those of the "honeycomb" type will generally be preferred to labyrinth ones, sometimes coupled with brush-seals. This together determines the need to calculate the dynamic coefficients in a cost-effective manner in the face of CFD models with a huge number of nodes and to effectively resolve the non-linear problems that are determined by the contact of the brushes which can induce an instability called "a spiral". The use of working fluids as lubricants simplifies the design from the point of view of containment and contamination, but raises the problem of modeling the fluid in multiphase conditions, in special models in the case of sCO₂.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>Alongside conventional CFD models, implemented with commercial software, methods will be used that allow the extrapolation of results in the face of variations in operating parameters on the basis of a limited set of AI-based simulations</p>



	based simulations
Educational objectives	The candidate will develop a solid knowledge in modeling some critical components of modern rotating machines designed for the energy transition.
Job opportunities	List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research include: Baker Hughes – Nuovo Pignone, Ansaldo Energia, Exergy, Turboden, Texas A&M University (USA), Université de Poitiers (FR), Northwestern Polytechnical University (PRC), Tsinghua University (PRC)
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 5 PhD Students
Name of the research directors	Prof. Paolo Pennacchi

Contacts
For questions about scholarship/support please contact phd-dmec@polimi.it

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	750.0 €
By number of months	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 6.114,50.</p> <p>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).</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by</p>



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.