POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

PNRR 117 Research Field: NUMERICAL MODELLING SOLUTIONS FOR THE FRACTURE MECHANICS-BASED DESIGN OF HIGH PRESSURE HYDROGEN STORAGE VESSELS

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	Hydrogen storage solutions are fundamental for the development of the hydrogen economy. The objective of this research is the definition of appropriate modelling solutions for the fracture mechanics based design of pressure vessels for hydrogen storage, focusing, among other factors, on on the effect of autofrettage of steel cylinders on the fatigue crack behaviour. The objective of this research is the definition of appropriate modelling techniques, to account for the variability of the manufacturing process on the properties of the material, of the effect of hydrogen on the properties of the material and the behavior of the structure, to design new and more reliable pressure vessels. New solutions of the monitoring of the autofrettage process will be studied.These objectives are coherent with the M2 Green revolution and ecological transition of the PNRR, and also with the mission M4 Education and Research, M4C2 From Research to Business, particularly with respect to the line of action 1 aiming at strengthening Research and Development in the research system and in the economic system.
Methods and techniques that will be developed and used to carry out the research	To carry out this research, a combined experimental and numerical approach is needed. The candidate shall be able to conduct mechanical characterization of metals, to model the mechanical behaviour of metal materials and structures and to apply the concepts of plasticity and fracture mechanics to the design of pressure vessels. A

	fracture mechanics to the design of pressure vessels. A Finite Element based approach will be applied and new methods will be developed, integrating the variability of the materials' properties as a result of the manufacturing process (e.g. eccentricity, non-uniform distribution of the material properties). The candidate shall possess a solid background in solid mechanics, finite element modelling and fracture mechanics.
Educational objectives	The Doctor in Mechanical Engineering will be able to define, start and carry out original research by working in a team or leading a research group. Both theoretical and experimental skills will be mastered
Job opportunities	The holder of a PhD in Mechanical Engineering will have job opportunities in structures/organizations aimed at innovation and/or research and technical development, high-tech SMEs, and government departments ruling on public needs. Specifically, the proposed research topic can offer job opportunities in the field of advanced manufacturing of composite structures. 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.
Composition of the research group	2 Full Professors 1 Associated Professors 1 Assistant Professors 6 PhD Students
Name of the research directors	Prof. Andrea Bernasconi

Contacts
Phone: +39 02 2399 8222 *Email*: andrea.bernasconi@polimi.it 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	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)	Dalmine 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)	to be defined
By number of months abroad	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 euro 5.707, 13.

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.