



PhD in SCIENCE, TECHNOLOGY AND POLICY FOR SUSTAINABLE CHANGE - 39th cycle

THEMATIC Research Field: INTEGRATION OF ARTIFICIAL INTELLIGENCE IN THE PROBABILISTIC MODELLING OF POLLUTANT TRANSPORT FOR THE RISK ASSESSMENT OF AQUIFER CONTAMINATION FROM INDUSTRIAL ACTIVITIES

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	<p>The objective is to address the problem of pollutant transport across heterogeneous aquifer systems within a probabilistic risk assessment framework coping with various sources of uncertainty (i.e., conceptual/model and parametric uncertainty, including uncertainties related to extreme climate events). The research is aimed at identifying time-dependent preferential pathways of pollutants across groundwater systems and leverage on a stochastic approach to model their transport across complex hydrogeological systems, when the a risk assessment of aquifer contamination from industrial acrivities must be conducted. A unique framework to assess and propagate uncertainty in a systematic and transparent way across heterogeneous aquifer systems will be developed by (a) quantifying uncertainty through ensemble and information theory techniques, (b) assessing data-worth (including data-assimilation frameworks) via probabilistic inverse modeling, and (c) model reduction through physics-based artificialintelligence (Physics Based Neural Networks, PINN), and local and global sensitivity analysis. The research activity conducted within the RETURN ? PartenariatoEsteso Multi-Risk Science For Resilient Communities Under a Changing Climate (Piano Nazionale di Ripresa e Resilienza - PNRR), Spoke VS4: Environmental</p>



<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The research activity aims at developing innovative artificial intelligence and sensitivity analysis methods for the probabilistic modeling of pollutant transport for the risk assessment of aquifer contamination from industrial activities. Methods and techniques to be considered for this (in an integrated manner) are: Physics Based Neural Networks, Deep Artificial Neural Networks, Convolutional Artificial Neural Networks, Generative Adversarial Networks, Reservoir Computing, Support Vector Machines, Grey-box models, Genetic Algorithms, Evolutionary Optimization, Kriging Metamodels, Bayesian Inverse Uncertainty Quantification Methods, local and global sensitivity analysis methods, variance-based and distribution-based methods, information theory techniques for sensitivity analysis. The PhD student will benefit from the international and interdisciplinary research teams involved in the RETURN – Partenariato Esteso Multi-Risk Science For Resilient Communities Under a Changing Climate (Piano Nazionale di Ripresa e Resilienza - PNRR), Spoke VS4: Environmental Degradation.</p>
<p>Educational objectives</p>	<p>To prepare a RAMS (Reliability, Availability, Maintainability and Safety), Risk and Resilience professional, expert and competent researcher with the technical skills, algorithmic knowledge and system analysis capabilities for evaluating and making decisions for preventing and managing the risk of industrial systems, with also specific domain expertise and consideration of pollutant transport and aquifer modeling.</p>
<p>Job opportunities</p>	<p>RAMS, reliability, maintenance, safety, risk engineer and manager, data analyst in support of decision making for complex industrial systems (e.g., energy generation and distribution, nuclear, chemical, etc.) design, operation, management and regulation, researcher in national and international research centers and universities.</p>
<p>Composition of the research group</p>	<p>2 Full Professors 1 Associated Professors 1 Assistant Professors 12 PhD Students</p>
<p>Name of the research directors</p>	<p>0</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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p><i>Educational activities:</i> 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. This amount is equal to 10% of the annual gross amount, for 3 years.</p> <p><i>Teaching assistantship:</i> 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><i>Computer availability:</i> individual use. <i>Desk availability:</i> individual use.</p>