



# PhD in INGEGNERIA AMBIENTALE E DELLE INFRASTRUTTURE / ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING - 39th cycle

## Research Area n. 3 - Environmental and Hydraulic Engineering and Geomatics

Number of scholarship offered	3
Department	DIPARTIMENTO DI INGEGNERIA CIVILE E AMBIENTALE

### Description of the Research Area

This Area main topics are:

**Environmental Engineering:** 1. Water supply technology and treatment, disposal and reuse of wastewater, advanced biological and physical-chemical water and wastewater treatment; sludge management and disposal; anaerobic digestion processes. 2. Management and planning of environmental resources: source apportionment of pollutant loads; water quality modelling, scenario analysis and knowledge-based decision support systems of management alternatives. 3. Solid wastes and sludge minimization and management. 4. Phenomenology of atmospheric environment and treatment of gaseous emissions. 5. Contaminated soil, sediment and groundwater: characterization, risk assessment, in-situ and on site remediation technologies.

**Hydraulic Engineering:** fluid mechanics; fluid-structure interactions; hydraulic measurements; river hydraulics; hydraulic risk quantification and management; flow and transport processes in porous systems; hydraulic networks. Experimental, modeling and methodological aspects are considered. Key research areas include: 1. Fluid mechanics. Key topics include analysis of advanced methodologies of computational and experimental fluid dynamics (e.g., image analysis techniques for hydraulic processes on multiple observational scales) and modeling of processes of fluid-structure interactions for environmental, civil and industrial engineering applications. 2. River hydraulics and sediment mechanics. Key topics include modeling of free surface flows, local and general scour processes, hyper-concentrated flows, flooding and hydraulic risk quantification and management. 3. Flow and transport processes in porous systems. Key topics include: characterization of hydraulic properties from pore- to aquifer system- scales; well testing; inverse modeling / history matching / data assimilation; flow and multicomponent reactive transport process in heterogeneous media under uncertainty and probabilistic risk quantification; multiphase flows, including oil and gas reservoir engineering; scaling of hydrogeological



quantities; mixing processes in coastal aquifers; geothermal fluxes at the reservoir and basin scales; enhanced oil recovery.

**Geomatics:** all disciplines dealing with positioning, global and local reference system establishment, surface surveying and reconstruction from a global scale down to the scale of the individual architectural manifold, representing data by graphical or virtual tools, archiving and cross-referencing spatial information in terms of geographic information systems. Summarizing, we can identify the following education and research topics: 1. Physical geodesy and satellite geodesy, including estimation and representation of the gravity field at all scales and its geophysical interpretation. 2. Positioning, deformation estimation and navigation, with the use of both classical and satellite techniques, such as GPS. 3. Surface surveying with optical or other sensors, such as SAR, LIDAR, etc., at different scales from regional down to the manifold scale. 4. Digital photogrammetry and image analysis, including the development of photogrammetric software for the geometrical reconstruction of surfaces and feature extraction. 5. Remote sensing, namely the problem of identifying, by suitable spectral analysis, specific geographic information. 6. Geographic information systems, with application of the most modern technology for internet GIS and mobile GIS. Cultural heritage reconstruction and archiving, with the solution of complex problems of combination of different data into a unique data base, providing three-dimensional virtual models that preserve full geometrical and metrical information.



# PhD in INGEGNERIA AMBIENTALE E DELLE INFRASTRUTTURE / ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING - 39th cycle

Research Area n. 3 - Environmental and Hydraulic Engineering and Geomatics

**OPEN SUBJECT Research Field: ENVIRONMENTAL AND HYDRAULIC ENGINEERING AND  
GEOMATICS**

Monthly net income of PhDscholarship (max 36 months)
--

**€ 1195.5**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
----------------------------------	--

<b>Motivation and objectives of the research in this field</b>	<p>Key research areas are keyed to environmental, civil and industrial engineering applications and include:</p> <ul style="list-style-type: none"> <li>- Air/Soil/Water quality management and treatment/remediation technologies;</li> <li>- Waste management;</li> <li>- Environmental impact, risk assessment and management;</li> <li>- Computational and experimental fluid dynamics;</li> <li>- River hydraulic and sediments mechanics, flooding;</li> <li>- Flow and transport processes in porous systems;</li> <li>- Theoretical and mathematical geodesy;</li> <li>- Statistical data analysis and management;</li> <li>- Remote sensing, satellite positioning, surveying technologies, geographic information systems.</li> </ul>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>Research is performed upon integrating (a) methodological and basic theoretical aspects, (b) field- and laboratory-based experiments/observations, and (c) conceptual and numerical model development and implementation strategies within a unified framework.</p>
<b>Educational objectives</b>	<p>The main objective is the education of professionals and scientists who can design and develop autonomous</p>



	research plans and activities with critical expertise in environmental and hydraulic engineering and geomatics.
<b>Job opportunities</b>	Main opportunities in the job market include Universities, Research Centers, top level management in Authorities involved in environmental policy, senior consultants for engineering companies, high level personnel for the industry, instruments and geographic information management.
<b>Composition of the research group</b>	10 Full Professors 14 Associated Professors 12 Assistant Professors 25 PhD Students
<b>Name of the research directors</b>	R. Canziani-M. Riva-R. Barzaghi

<b>Contacts</b>
roberto.canziani@polimi.it (Ph: +39-02-2399-6410)
monica.riva@polimi.it (Ph. +39-02-2399-6214)
giovanna.venuti@polimi.it (Ph: +39-02-2399-6524)

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	597.75 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year: max 1620.00 euros per student on average.</p> <p><u>Teaching assistanship</u> (availability of funding in recognition of support to 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</p>



by the regulations.

Computer availability and desk availability: 1<sup>st</sup> year +2<sup>nd</sup> year +3<sup>rd</sup> year: individual use.