



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 40th cycle

PNRR 630 Research Field: NUMERICAL MODELLING AND EXPERIMENTAL ANALYSIS FOR THE ANALYSIS OF ADVANCED NUCLEAR REACTORS

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	
Motivation and objectives of the research in this field	<p>Energy is today at the forefront of the World as well as of the European and Italian concerns, because of the emerging, new trilemma: global warming, strategic and geo-politic dependence, economic impact. The ecological transition is one of the key pillars of the EU policies as well as of the Italian recovery plan (PNRR). Nuclear energy represents today almost 50% of the carbon-free electricity in EU. According to IPCC reports, the CO2 equivalent emissions per kWh produced for nuclear are equivalent to wind power and lower than photovoltaic. In such a framework, Generation-IV fission technologies and in general Advanced Nuclear Reactors as Molten Salt Reactor (MSR) and Micro Reactors may play an important role in generating CO2-free, reliable and programmable energy supply in the long run. In the effort of supporting the Advanced Nuclear Reactors design, mathematical and numerical modelling tools are essential for guiding the engineering choice. The accuracy of the modelling tool is important as well as its capability to consider the uncertainties arising from limited experience, scientific understanding, and imperfect simulations and models. The aim of the research is then to identify the characteristics and the capabilities required by an Advanced Nuclear Reactor in terms of uncertainty assessment both from a numerical and experimental point of view and to develop appropriate numerical and</p>



	<p>experimental methodology to support the design and the engineering development of new reactors. The objectives of the research are in line with the topics targeted by DM 630/2024, in the Mission 4, Component 2 "From research to enterprise" (M4C2) aiming at increasing high-level skills for fulfilling the innovation needs of companies. The PhD candidate will spend at least 6 months at Milano Multiphysics, an Italian startup active in the field of industrial engineering, data analysis, and numerical simulation.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>A comprehensive approach will be adopted, to both complement the numerical modelling/experimental evaluation and uncertainty evaluation. A technique that will be developed and used is the Generalized Perturbation Theory and its application to Monte Carlo simulation for the neutronics analysis (e.g., for the analysis of the uncertainty in the power distribution). Among the state-of-the-art simulation codes: SERPENT (neutronics) and OpenFoam (CFD - multiphysics).</p>
<p>Educational objectives</p>	<p>The PhD candidate will develop high-qualified skills and expertise in the nuclear energy & innovative reactors area, with a focus on Advanced Nuclear Reactor as Molten Salt Reactor and Microreactors. In addition, the PhD candidate will be able to perform high-level research activity, especially in the industrial field to create high-skilled professionals able to satisfy the innovation need of the companies.</p>
<p>Job opportunities</p>	<p>The candidate profile will be highly attractive both in the research environment, where cross-disciplinary skills are more and more appreciated, and in the expanding field of fission energy system design, analysis, manufacturing and management.</p>
<p>Composition of the research group</p>	<p>1 Full Professors 3 Associated Professors 1 Assistant Professors 15 PhD Students</p>
<p>Name of the research directors</p>	<p>Stefano Lorenzi</p>



Contacts	
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Stefano Lorenzi stefano.lorenzi@polimi.it
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Research Group web site www.nuclearenergy.polimi.it
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Additional support - Financial aid per PhD student per year (gross amount)	
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Housing - Foreign Students	--
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Housing - Out-of-town residents (more than 80Km out of Milano)	--
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Scholarship Increase for a period abroad	
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Amount monthly	750.0 €
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By number of months	6
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National Operational Program for Research and Innovation	
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Company where the candidate will attend the stage (name and brief description)	Milano MultiPhysics
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By number of months at the company	6
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Institution or company where the candidate will spend the period abroad (name and brief description)	to be defined
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By number of months abroad	6
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Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Educational activities: 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. The amount is about Euro 5000.

Teaching assistantship: 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.

Computer availability: individual use.

Desk availability: individual use. Accommodation in Politecnico's Residences (<http://www.residenze.polimi.it>) is available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application).

Research period abroad: Our candidates are strongly encouraged (6 months minimum is mandatory) 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).