



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

THEMATIC Research Field: RESPONSE OF STRUCTURE DYNAMICS TO TURBULENT FLOWS

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

The study of the atmospheric boundary layer and its interaction with civil and mechanical structures is of fundamental importance to understand the impact of flow turbulence not only on static structures, but also on dynamic structures. The activity is meant to be conducted using Computational Fluid Dynamics (CFD) using an open-source framework. The first objective of the study is to reproduce the relevant characteristics of the atmospheric wind both considering the average flow, as well as the unsteady features. The impact of the turbulent wind will be evaluated on dynamic structures, such as wind turbines in the wind energy field and suspension bridges and high rise buildings in the wind engineering field. Wind turbines are generally clustered in arrays as wind farms, the interaction between them happens through the wake interaction that is strongly affected by the wake mixing induced by the wind turbulence. Suspension bridges are subject to wind forces associated to their relative wind incidence angle. The relative wind can be imputed to vertical displacement of the bridge section, or to rotation of the bridge section: these motions can be calculated considering the dynamics of the entire bridge. A complimentary approach that uses the bridge aerodynamic coefficients and the flutter derivatives for bridge sections, that can be calculated using CFD in smooth and turbulent flow. High rise building are impacted by turbulent flow, that affect the loads on the structure as well as on the cladding. Wind turbulence affects the



	dynamics of the building, inducing oscillatory motion.
Methods and techniques that will be developed and used to carry out the research	The work will be done coupling Computational Fluid Dynamics (CFD) models with system dynamics models. The CFD framework will be open-source and a HPC infrastructure will be used. Experimental activity will be performed to gather data suitable for the validation of the numerical models and the response of the structures. Post-processing of CFD results will allow to gather more insight in the physical phenomenon, giving some additional information for understanding the interaction of structures with turbulent flow.
Educational objectives	Develop advanced CFD models that combine Fluid-Dynamics and System Dynamics. Experimental background to have a physical understanding of the phenomenon. Combine and master different modelling techniques. Develop competences on innovative components. Multi-disciplinary competencies. Methodological competences at both the theoretical and applied level. Problem setting and solving capabilities. Develop team-working attitude.
Job opportunities	Wind Energy and Wind Engineering field CFD specialist Vehicle aerodynamics Bridge aerodynamics
Composition of the research group	3 Full Professors 3 Associated Professors 2 Assistant Professors 5 PhD Students
Name of the research directors	Proff. Paolo Schito, Alberto Zasso

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)	--
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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 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.</p>