ANIV-G DAY

Pisa, September 08th 2024

organized by

ANIV-G

together with IN-VENTO 2024 Conference

ANIV-G

ANIV-G is the group of young researchers within ANIV. Its goal is to promote cooperation in the Wind Engineering discipline, ease the exchange of ideas, support the spreading of knowledge, and favour contamination with other scientific communities. The group is open to students, PhDs, researchers, and practitioners who are interested in deepening their knowledge, sharing their experience and contributing to the development of Wind Engineering. Not limited to ANIV members and no membership fees required, ANIV-G is devoted to young researchers actively working in an Italian company or institution, or who has obtained a Ph.D. in an Italian university.

ANIV-G DAY 2024

During the ANIV-G PhD session, members have the opportunity to thoroughly present their research and socialize without the usual formalities of a traditional scientific conference. Goals, methodologies, main findings, and challenges are all welcome.
The ANIV-G PhD session will be organized as follows:
1. Poster session: All attendees will prepare a poster showcasing their research (goals, questions, ongoing activity, methodology) to socialize in an informal environment. The topic and content of the poster are entirely up to you. This activity is primarily designed for first- or second-year PhD students.
2. My PhD in three minutes: All attendees will deliver a 3-minute presentation to showcase their PhD research and pique the audience's curiosity. The topic and content of the presentation are flexible but be mindful of the time limit! The audience will vote for the best presentation based on clarity, quality of supporting material, and adherence to the time limit. This activity is mainly for third-year PhD students or early PostDocs.
3. My PhD in detail: The top two qualifiers will be awarded the opportunity to present their research exhaustively with a 30-minute presentation (20 minutes talk + 10 minutes Q&A) and celebrate with a toast!

GENERAL PROGRAM

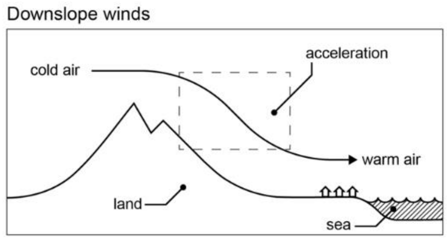
The ANIV-G events will be on September 08th. The general program is organized as follows:

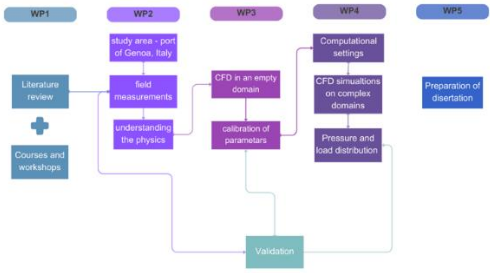
13:30 – 15:00	ANIV-G Meeting
15:00 – 16:00	Poster session
16:00 – 18:00	PhD Session
from 19.00	Aperitivo

POSTER SESSION

Ivana Ivančić – *IUSS Pavia*

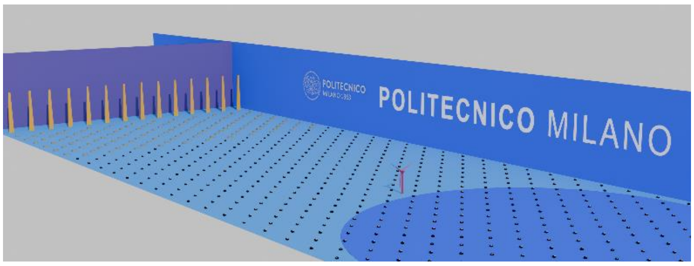
Risk assessment of port exposure to extreme winds





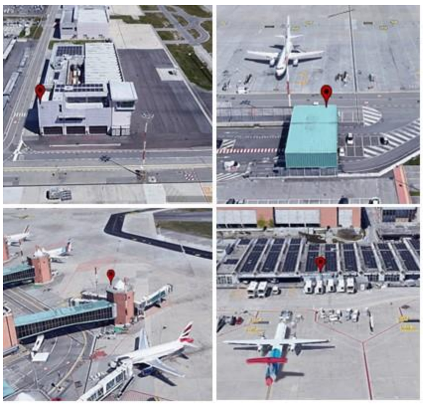
Tiziano Leone – *Politecnico di Milano*

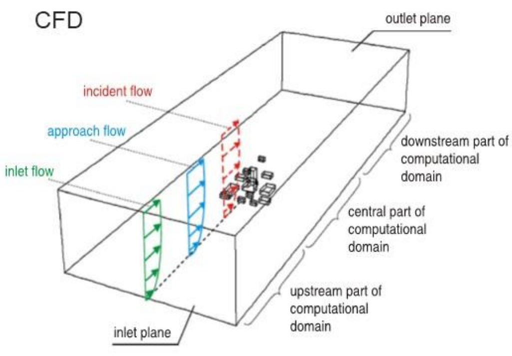
Wind tunnel numerical modeling for wind farm control strategies



Priyadarshi Maurya – *IUSS Pavia*

Adaptive response to climate change for safety management airport infrastructures under strong winds

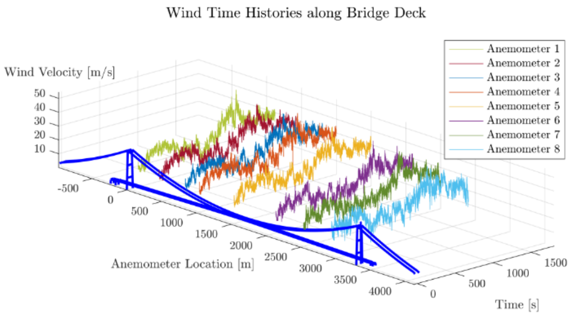


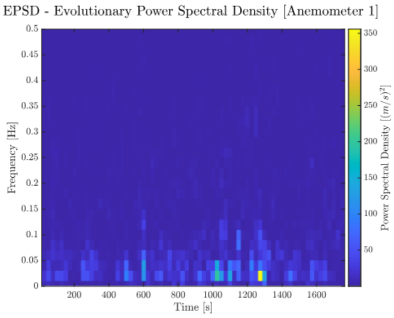


credit to Blocken et al. 2007

Maria Antonietta Pace – *Politecnico di Milano*

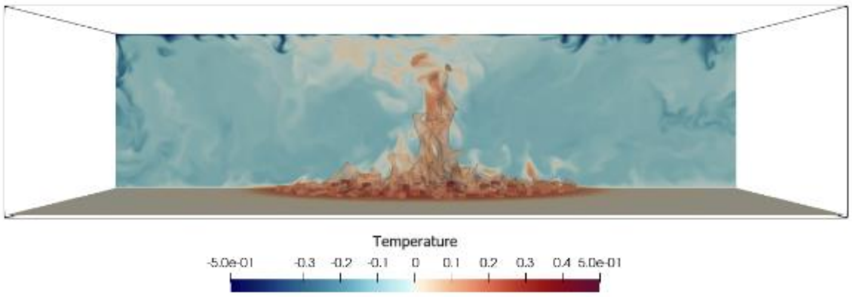
Aerolasticity of long span bridges under non-synoptic events

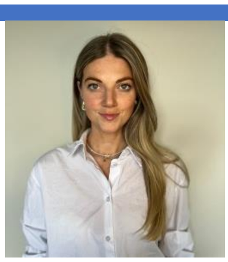




Anna Pavan – *Università degli Studi di Modena e Reggio Emilia*

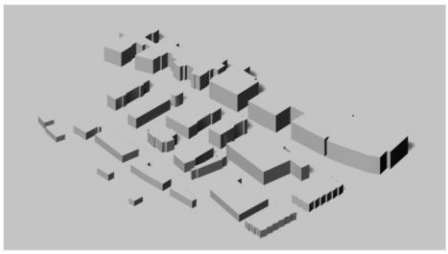
Towards a general approach for the study of Urban Heat Island

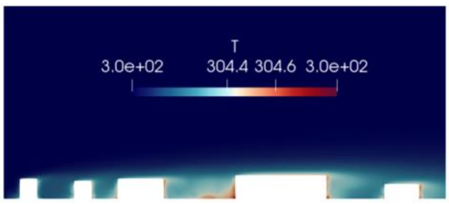


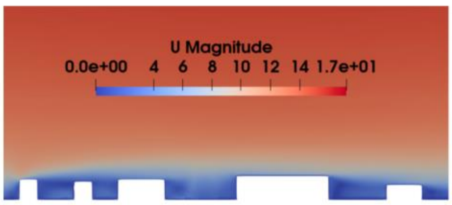


Alessia Piazza – *Università di Genova*

Climate change: wind and temperature hazards in urban environments







PHD SESSION

Camila Aldereguía Sanchez – *Università di Genova*

Thunderstorm induced actions on tall buildings

Hao-Yu Bin – *Università di Genova*

Simulation of transient characteristics of thunderstorm outflows in straight-line wind tunnel tests

Filippo Calamelli – *Politecnico di Milano*

Effects of small and large scales of wind turbulence on bridges

Gianmarco Lunghi - *Università di Pisa*

Experimental and numerical investigations on separated flows

Ettore Sorge - *Università Degli Studi di Napoli Parthenope*

Reducing structural demand on wind turbines

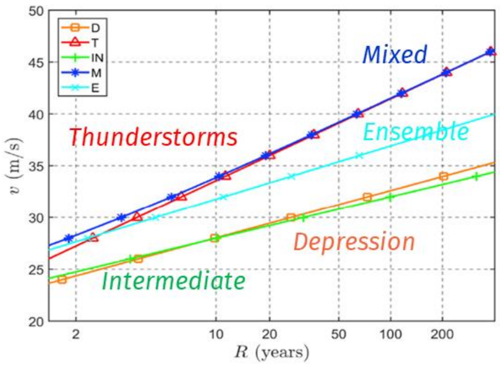
ABSTRACTS

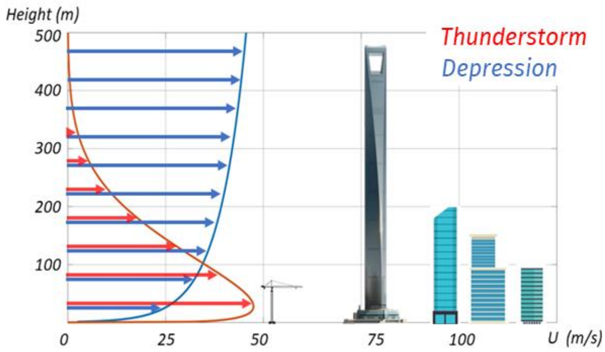
Camila Aldereguía Sanchez

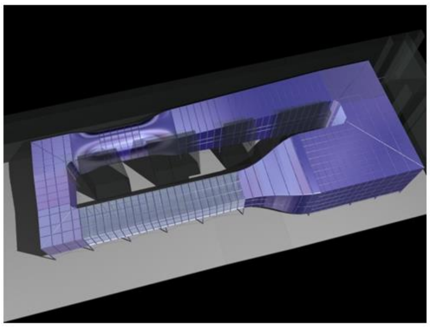
Università di Genova

Thunderstorm induced actions on tall buildings

Tall buildings are highly sensitive to wind-induced forces. The methodology to obtain the wind forces is based on models developed for synoptic events and design wind speeds from codes or derived from the statistical analysis carried out generally without separating different phenomena. However, in mixed wind climates, thunderstorms can significantly influence design wind speeds, and their features differ from those of synoptic events. It includes a nose-shaped mean wind speed profile and nonstationary characteristics over intervals of 10 minutes to 1 hour. This research explores the impact of thunderstorm-induced winds on tall buildings, comparing these effects with those from synoptic winds. The study uses statistical analysis to determine design wind speeds for various return periods, utilizing anemometric and Lidar data while considering both individual and mixed event distributions. Wind tunnel tests are conducted in the Boundary Layer Wind Tunnel (BLWT) at the University of Genoa to examine the effect of the downburst mean wind speed profile. These experiments employ a passive device designed for this purpose. Two testing methods, Force Balance and Pressure Integration, are used on the CAARC building and another tall structure to assess the wind forces and dynamic responses induced by thunderstorms and synoptic events.



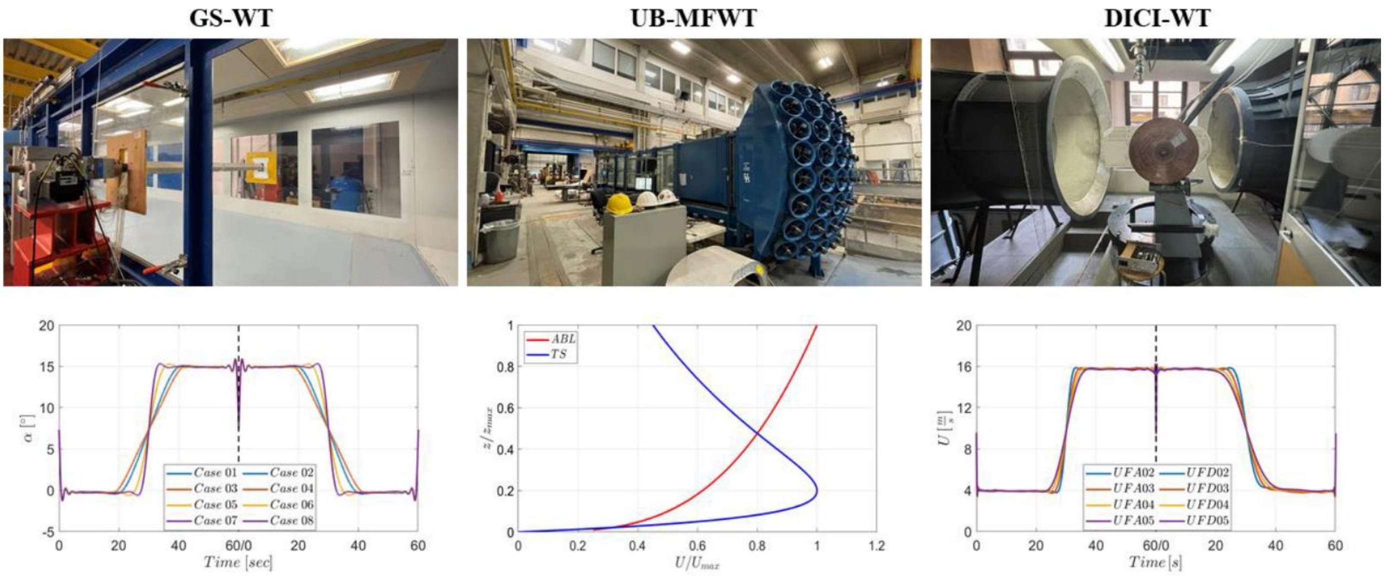




Hao-Yu Bin
Università di Genova

Simulation of transient characteristics of thunderstorm outflows in straight-line wind tunnel tests

Building on the extensive research conducted by the Wind Engineering research group at the University of Genoa on thunderstorm outflows, this PhD thesis explores the transient aerodynamics and aeroelasticity of bluff bodies using an experimental approach. The focus is on three key aspects of thunderstorm outflows: transient angle of attack, the nose-like vertical wind profile, and transient wind velocity. These variables will be independently simulated in wind tunnel experiments to investigate the potential differences that transient conditions may introduce compared to the approach commonly used for steady winds. This research utilizes three different wind tunnels: (i) the traditional closed-circuit wind tunnel at the University of Genoa (GS-WT), equipped with a step-motor system for generating time-varying angles of attack; (ii) the multiple fans wind tunnel at the University at Buffalo (UB-MFWT), featuring 64 individually controlled fans to simulate varying vertical wind profiles; and (iii) the Goettingen-type wind tunnel at the University of Pisa (DICI-WT), with a newly installed fan motor capable of producing accelerating flows. The research aims to integrate theoretical insights with experimental findings, expected to provide valuable guidance for wind load design in engineering applications.

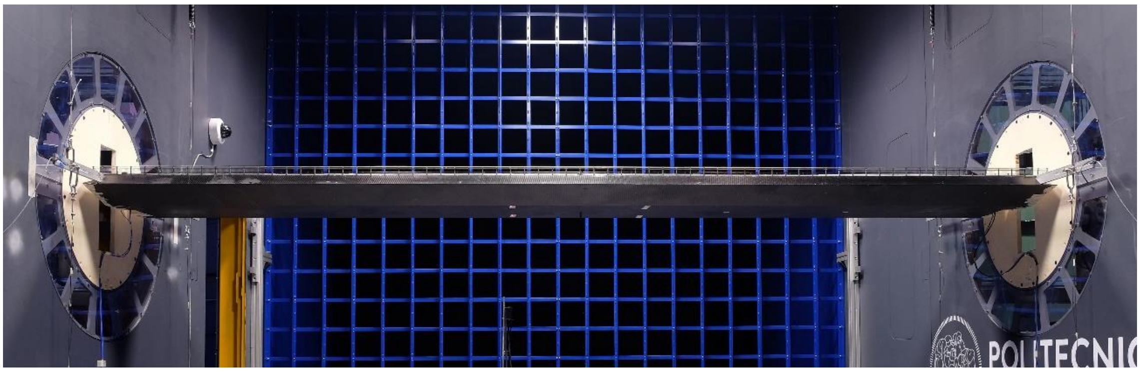


Filippo Calamelli

Politecnico di Milano

Effects of small and large scales of wind turbulence on bridges

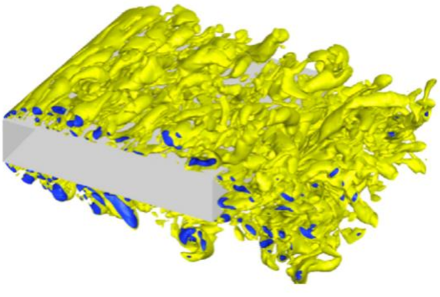
A fundamental part of atmospheric winds is turbulence, which involves random fluctuations spanning a wide range of frequencies. These frequencies are linked to spatial scales: small vortices correspond to high frequencies, while larger vortices are associated with lower frequencies. These different scales affect wind-induced problems on bridges in various ways, interacting with the structure's dynamic behavior and surrounding fluid dynamics. Small-scale turbulence alters pressure distribution around the bridge deck, impacting the resulting aerodynamic forces. Otherwise, large scales cause slow modulation of wind speed and angle of attack, leading to unsteady changes in the flow characteristics around a bridge deck. Depending on the aerodynamic properties, such fluctuations may lead to nonlinearities in the aerodynamic forces, which can be enhanced by extreme weather events like storms and downbursts, which feature sudden and localized changes in wind speed and angle of attack. The study presented in this thesis focuses the problem, analyzing both small and large-scale turbulence effects on the aeroelastic behavior of bridges. Small scales effects were investigated experimentally by generating a homogeneous turbulent flow impacting a deck sectional model of a bridge case study. To reach this purpose, a grid was designed and installed in the Politecnico di Milano wind tunnel. On the other hand, a nonlinear model able to account for large variations in wind speed and angle of attack is developed and employed to investigate the dynamic response of two different bridges subjected to non-synoptic storm winds.

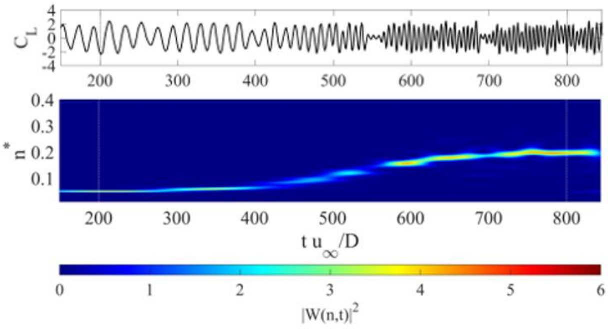


Gianmarco Lunghi
Università di Pisa

Experimental and Numerical Investigations on Separated Flows

The present work investigates the massively separated flows around bluff bodies, aiming at characterizing their properties and features. In particular, the research project examines the behavior of the high-Reynolds-number flows around rectangular cylinders of various chord-to-depth ratios, i.e., from the square to the 5:1 rectangular cylinder (BARC benchmark). These geometries can be assumed as simplified models for practical architectures, such as high-rise buildings and long-span bridge decks. Despite the simple geometries, these flows exhibit similar features of complex massively-separated flows. Indeed, they are characterized by a vortex shedding of considerable size affecting the wake; however, the different flow topologies are significantly affected by the presence of a local mean recirculation region on the cylinder side. A notable contribution is played by the degree of roundness of the upstream edges. In addition, a great relevance is also due to unsteady phenomena, as sudden flow accelerations caused by thunderstorm outflows. The synergic approach of numerical and experimental investigations, availing the former of highly-performed Large-Eddy Simulations and the latter of differential pressure and hot-wire velocity measurements in wind tunnel tests, widely favors a deeper insight into the physics of these phenomena and on the features these types of flows show. They also support a better ability to dispel a higher number of doubts and questions that a mere use of solely one of these investigative tools can leave open.





Ettore Sorge
Università Degli Studi di Napoli Parthenope

Reducing structural demand on wind turbines

The global energy crisis has highlighted the need for an urgent energy transition. Energy price volatility, fuelled by anti-competitive practices and political decisions, has brought inflation back to the centre of global economic challenges. However, the response to this 'polycrisis' has been a growing focus on sustainability and renewable energy. A significant growth in global wind power capacity is expected to meet the growing demand for energy. To increase productivity, large manufacturers are turning to taller wind towers, as height is crucial for the efficiency and output of wind farms. Taller towers make it possible to exploit more consistent and constant winds, improving the overall yield of wind farms. In parallel, advanced protection and monitoring devices are essential to ensure safety and maximise productivity. These include wind speed control systems, advanced braking and vibration mitigation devices. Advanced tower and blade monitoring allows early detection of anomalies or faults, facilitating rapid intervention and predictive maintenance strategies. The research work focuses on the development of a passive control system installed at the base of a wind turbine, integrating advanced aerodynamic models, refined structural modelling and laboratory testing, aimed at reducing fatigue and peak loads, contributing to the life extension of wind towers. The Hinge Spring Friction Device (HSFD) is the passive control system installed at the base of an onshore wind turbine.