UNIVERSITY OF TRENTO - Italy
Department of Civil, Environmental and Mechanical Engineering

SUMMER SCHOOL | SMALL WIND TURBINES: DESIGN AND TESTING

IN BRIEF

The task of the summer school is to give the participants a deeper knowledge of design and testing process of rotors and supporting tower of small wind turbines, covering the fundamentals of aerodynamic design, material selection, structural design and testing procedure. Additional important topics include wind resource and turbine performance measurements.
Theoretical insight are completed by practical experiments in lab and in field to demonstrate measurements and testing methodologies.

CRITERIA FOR ADMISSION AND OTHER INFORMATION

The summer school is a 4-days program designed for doctoral students, researchers and professionals in the field with a background in Engineering, wishing to in-depth study on design and testing on small wind turbines.
Applications for advanced undergraduate students with a major in Engineering may be considered.

Duration | 4 days, **3-6 September 2018**
Credits | 3 ECTS in the European system
Location | University of Trento and Riva del Garda (Italy)
Language | English

Deadline date for registration | 5th August 2018
Registration fee | 800 € (lodging expenses are excluded).

Organizer | University of Trento (Department of Civil, Environmental and Mechanical Engineering) and
Academic coordinator | prof. Lorenzo Battisti

in-vento
INNOVATION IN MICRO WIND ENERGY GENERATION
MEETINGS | CONTEST | EXHIBITION

PROGRAM (DRAFT)

	Monday, Sept.03	Tuesday, Sept.04	Wednesday, Sept.05	Thursday, Sept.06
8:30-8:45	Registration			
8:45-9:00	Summer School Opening			
Morning 9:00-13:00	**Blade Design** by W. Keller frontal lecture [in Trento University]	**Wind Blade Materials** by A.Pegoretti & H.Mahmood practical lecture [in Trento University]	**Wind & Turbine Performance Measurements** by L.Battisti frontal lecture [in Riva d. Garda]	**Advanced WT Fluid Dynamic** by J.N.Sørensen frontal lecture [in Riva d. Garda]
Afternoon 14:30-17:30	**Tower Design** by N.Tondini practical lecture [in Trento University]	**Wind Blade Structural Testing** by M.Molinari practical lecture [in Trento University]	**Social program** [in Riva d. Garda]	**Social program** [in Riva d. Garda]

KEYNOTE SPEAKERS

- Jens Nørkær Sørensen | Technical University of Denmark, Department of Wind Energy
- Walter Keller | KA Consult GmbH, Germany

LECTURERS OF UNIVERSITY OF TRENTO

- Alessandro Pegoretti | Department of Industrial Engineering
- Haroon Mahmood | Department of Industrial Engineering
- Lorenzo Battisti | Department of Civil, Environmental and Mechanical Engineering
- Nicola Tondini | Department of Civil, Environmental and Mechanical Engineering
- Marco Molinari | Department of Civil, Environmental and Mechanical Engineering

LEARNING OBJECTIVES

[1] Blade Design | 4 hours

A detailed review of the current state-of-art for small wind turbine blade design is presented, paying particular attention to the key matters:

- design of an optimum power-extracting blade (variable speed/fixed speed, and fixed/variable pitch operation);
- design approach for low wind speed sites;
- aerodynamic and mechanical noise reduction;
- buckling and fatigue analysis.

[2] Tower Design | 3 hours

The general design issues of wind turbine tower structures is presented, in a conjugated design with soil characteristic:

- modern standards and analysis methods;
- static and dynamic tests.

[3] Wind Blade Structural Testing | 3 hours

This lecture will address:

- blade static, modal and dynamic tests;
- practical experience with a static test is conducted in laboratory on a 3.5 m-blade.

[4] Wind Blade Materials | 4 hours

The use of different blade materials and experimentation with new materials is still in progress nowadays, and the blade material choice is crucial to reduce both cost and the probability of defects. This lecture will address:

- selection of blade materials and staking laminates for small wind turbine blade construction;
- composite material modeling, fiber orientation and thickness distribution on the composite material;
- practical experience with structural test on composite samples.

[5] Wind & Turbine Performance Measurements | 4 hours

Wind and turbine performance/loads measurements provide objective information on the actual wind turbine behavior, for both prototype and commercial products. This lecture will address:

- wind tunnel and infield testing, when and why;
- experimental tests procedure;
- handling and analyzing real-time data.

[6] Advanced Aerodynamic Aspects of Small Wind Energy Conversion Systems | 4 hours

Wind turbine aerodynamics concerns with the modeling and prediction of aerodynamic performances, and it is normally carried out in integrated aeroelastic codes to predicting performance and structural deflections. This lecture will address:

- the basics of the blade-element momentum theory along with guidelines for the construction of airfoil data,
- state-of-the-art advanced numerical simulation tools for wind turbine rotors and wakes.

CULTURAL PROGRAM

During the 4-days of the Summer School, an overview of cultural and professional events in Trento and Riva del Garda will be provided, including enjoying traditional food, sports and tours to explore the city by your own.

The Summer School will be held on the same week of the International **Colloquium TUrbWind 2018** (September 6th-7th | www.turbwind2018.org) on wind energy exploitation in urban environment, and **In-Vento | MEETINGS CONTEST EXHIBITION** (September 6th-8th | www.inventoinnovation.com/en/).