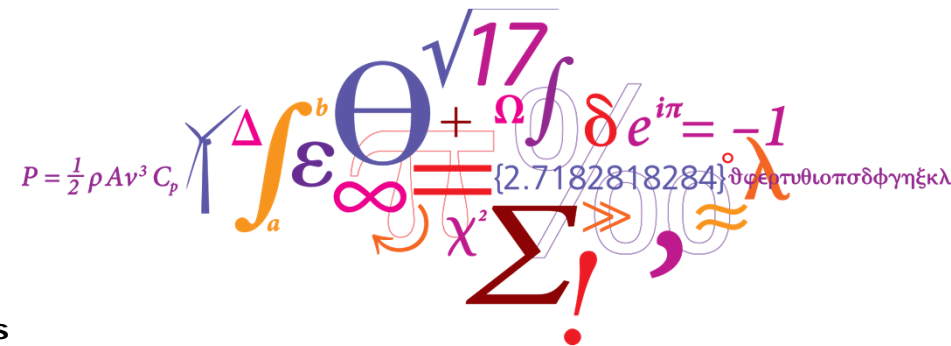


# Modal and static response of small wind turbine blade

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# Outline

This work is done as part of **EUDP INNWIND.EU** project, WP 2.2.4 – “Manufactured and laboratory tested scaled blades and parts of the blade”:

- The small blade model
- Dynamic testing of the blade
- Static testing of the blade

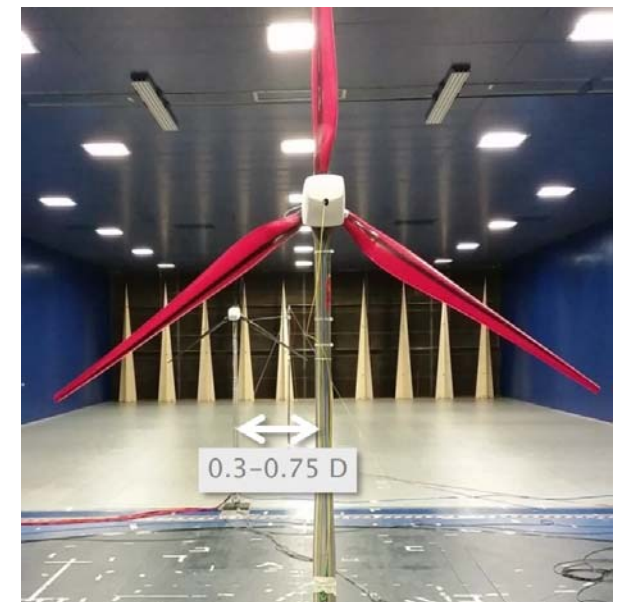
# The small blade model

**Provided by Politecnico di Milano (POLIMI):**

- To study passive and active load control in WT,
- DTU 10MW RWT aerodynamically/structurally scaled down to ca. 1 m long blades,
- Blade with carbon spar with biased fibers for Bend-Twist Coupling (passive control).



DTU 10MW RWT



POLIMI scaled down version of the 10 WM WT

# Dynamic tests. Setup



- PSV-500 Scanning Vibrometer  
Thanks to Jon Juel Thomsen, MEK!
- Blade mounted vertically
- All fixed on a heavy concrete blocks

**Non-contact measurement  
of the blade modal response**



# Dynamic tests. Blade excitation



- Blade was to be excited with random noise
- Piezo actuator on the aluminum plate was not enough
- Larger exciter acting directly on the blade root was working fine!

...and finally:

- A grid of measurement points on the blade surface



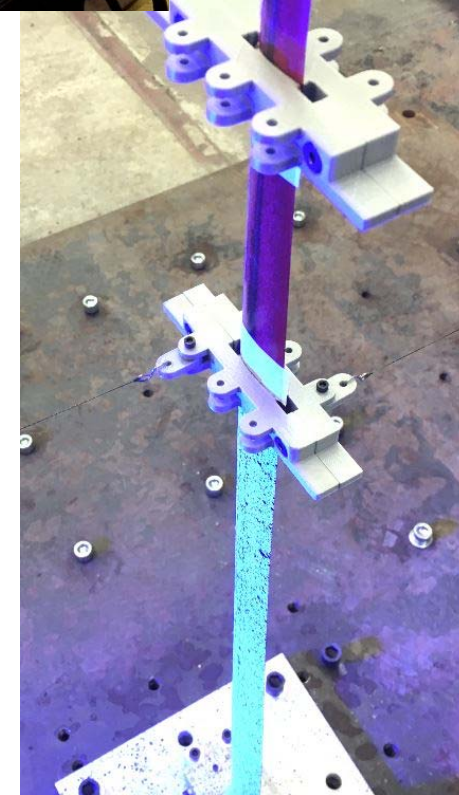
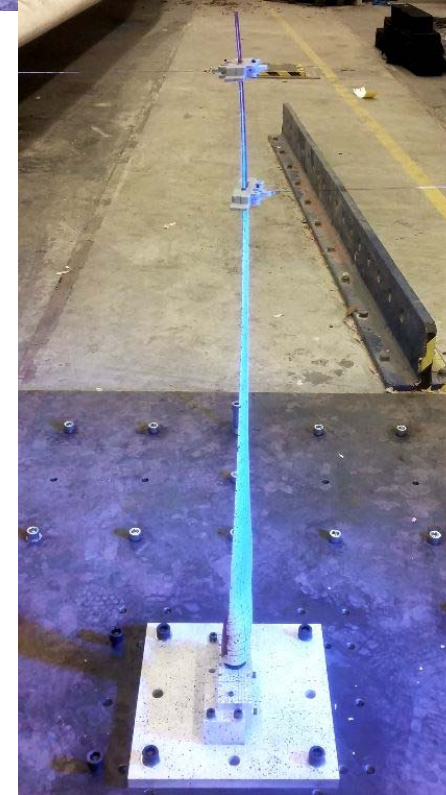
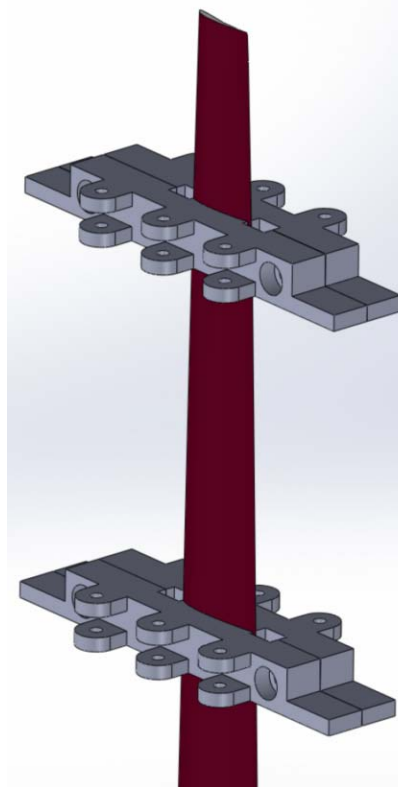


# Static tests. Setup

- Clamped vertically
- DIC ARAMIS for measurements
- Painted tape on blade surface
- Two special load clamps
- Calibrated dead weights as load

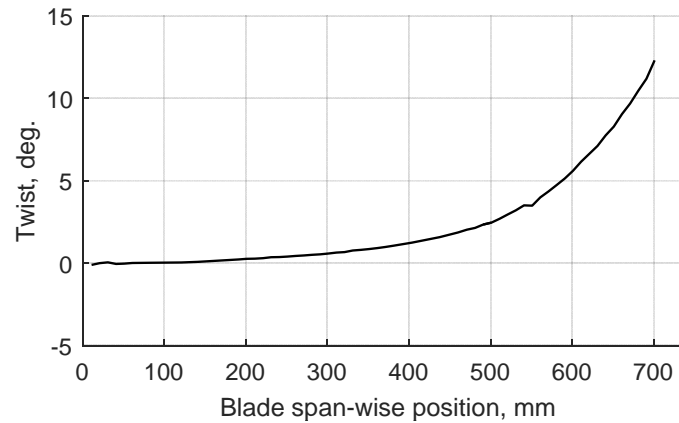
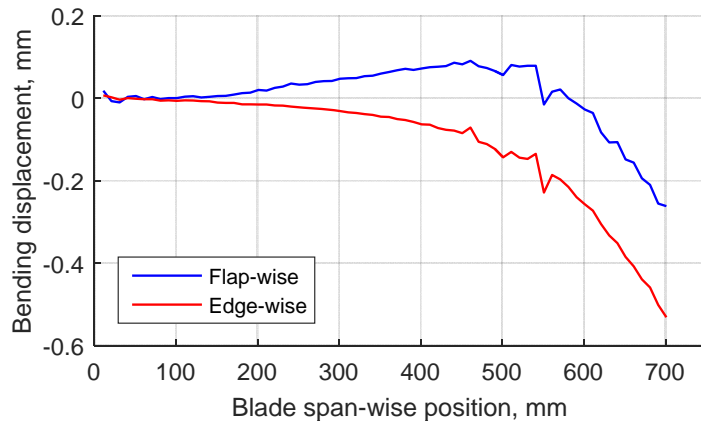
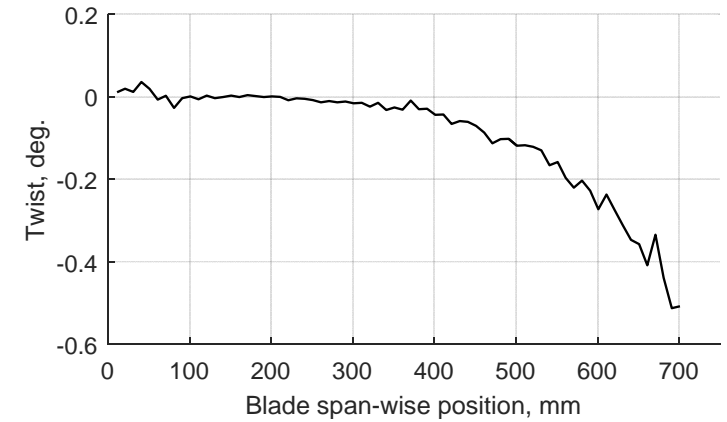
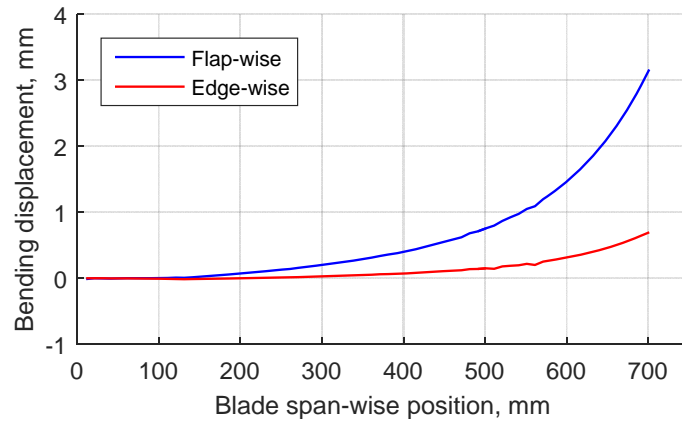
Load cases to study BTC:

- Shear force bending
- Pure bending (no shear force)
- Torsion



# Static tests. Results. Coupled response

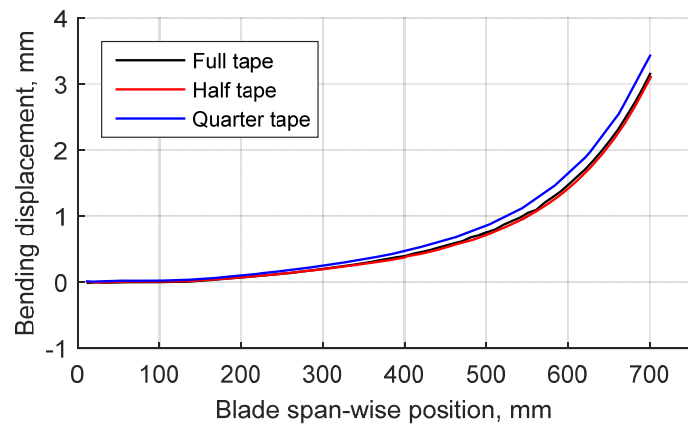
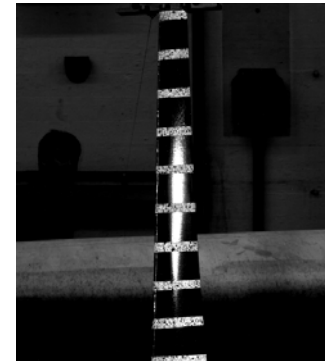
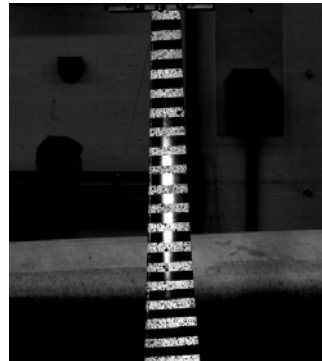
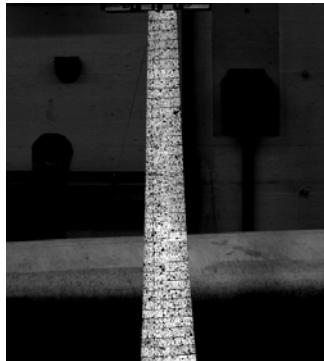
Deformations in bending case



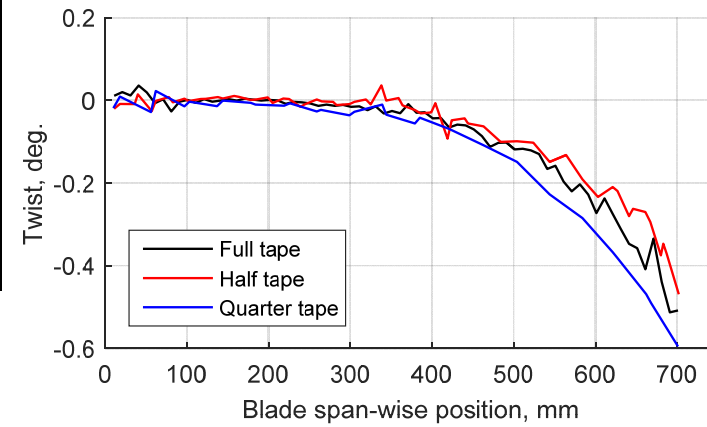
Deformations in torsion case



# Static tests. Results. Tape effect



Half tape



# Thank you for your attention!

Successful non-contact measurements on blade model with BTC:

- Modal response with scanning vibrometer
- Static response with digital image correlation

Questions?