Towards automated passive thermography of wind turbine blades

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BAM

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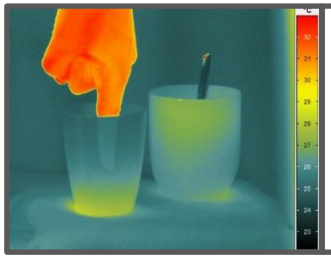
Passive Thermography:

Passive thermography is an imaging measurement of surface temperature (and its change) that provides information about the interior of components.



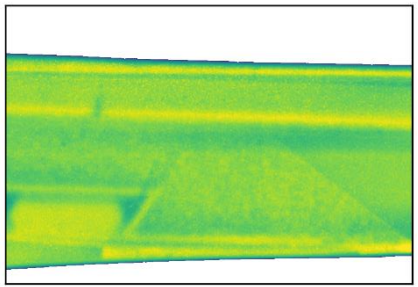
passive
(classical)

intrinsic heat source
(heating, body, electronics)

active

Use of a controlled
heat source
e.g. lamps, Laser, hot air...

When solar radiation and diurnal temperature changes are used, even (unheated) large structures such as wind turbine rotor blades can be inspected with passive thermography.



Passive thermography makes internal structures of a wind turbine rotor blade visible

Measurement setup

- IR camera:
  long-wave infrared, wavelength 8-9.4µm
  640 x 512 Pixel, 200 mm zoom lens
- optical camera + 500 mm zoom lens
- Electronic Pan-Tilt Unit (PTU)

The current measurement setup results in a resolution of approximately 1 cm/pixel at a distance of 100 m between camera and object.

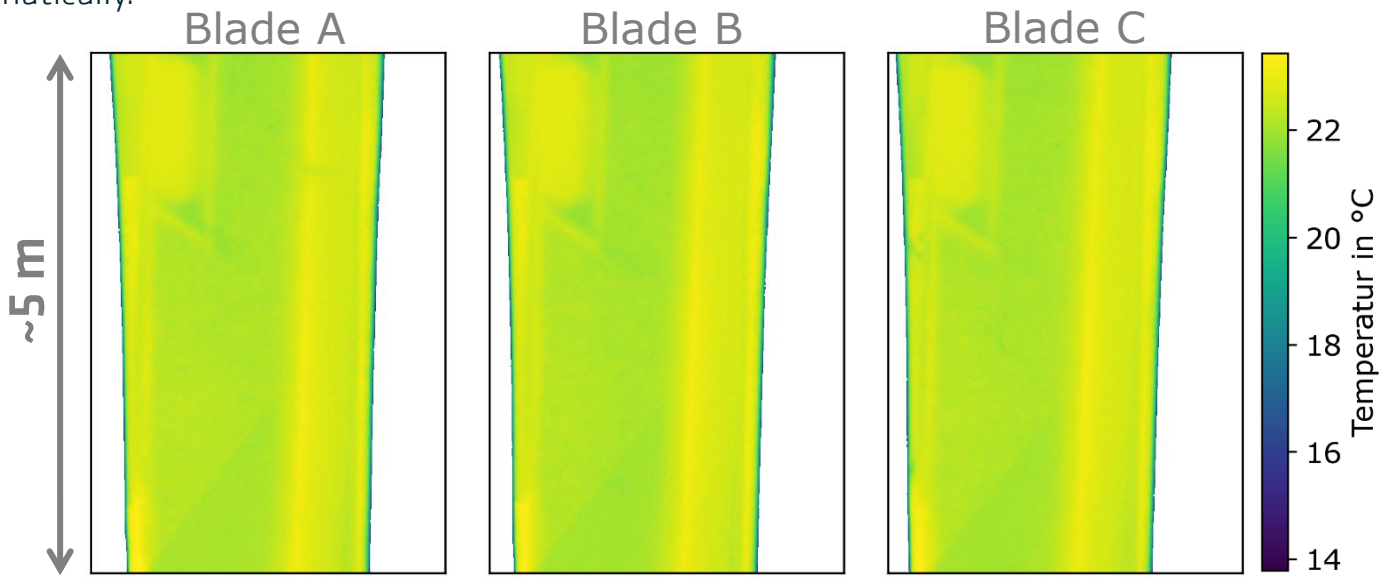
Measurements in the field during operation

Summer, 11. August, central Germany

1. The measurement makes a video of the **wind turbine in operation**
2. With the help of the PTU, **all blades** are scanned from the tip to the hub
3. Subsequently, the images with the same image sections for all three blades are determined by the software fully automatically.

Thanks you for the cooperation!!!

SAB WindTeam

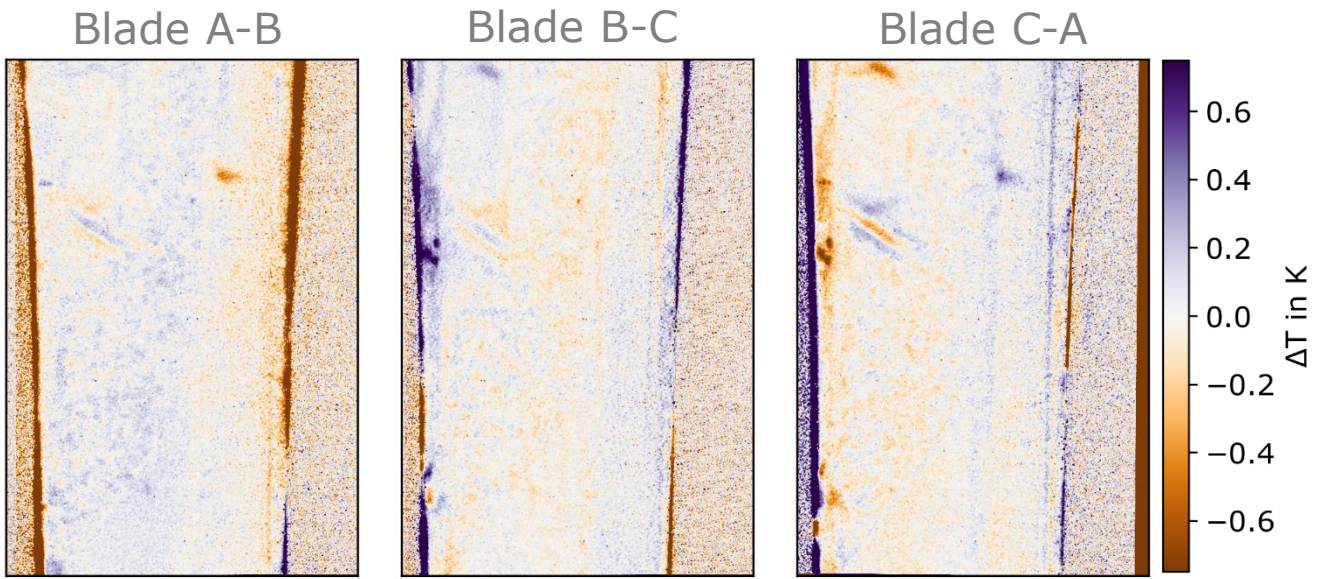


Measurements in the field during operation

Summer, 11. August, central Germany

4. To visualize **differences** between the blades which indicates irregularities and potential damages and separates these from visible design features, the thermographic images of the three blades are subtracted from each other.
5. Afterwards, the thermal differences can be used for the **identification and classification of irregularities**.

The data shown here were measured in operational business (rotating rotor) in only 15 minutes.



Further image processing

Full blade scan, image stitching & feature extraction

- For the subtraction of the image segments, the **superposition of these must be further optimized**. Only then it is possible to reliably detect defects at the edge of the rotor blade.
- An **ensemble image** must be put together from the individual image sections of the rotor blade (image stitching). In this way, the position of irregularities in the blade can be determined.
- In order to detect defects automatically, further algorithms must be developed to **detect and classify irregularities** in the images. The aim is to be able to distinguish between structural mechanical effects and defects.

Standing wind turbine blade full scan, time: 21:12