Weidmüller

BLADEcontrol®
CONDITION MONITORING SYSTEM

Reliable ice detection with different measuring methods

Dr.-Ing. Daniel Schingnitz, Marketing & Sales, Weidmüller Monitoring Systems GmbH

Winterwind – International Wind Energy Conference
Feb 3-5 2020, Åre, Sweden

Content

- System variants for reliable ice detection
- Icing events at turbines
- Wind farm monitoring
- Energy loss by heating without ice on the blades
- Conclusions

System variants for reliable ice detection

Close-to-root sensors

- Installation: 2 m from blade lid
- In case of retrofit easy to install (i.e. requirements Health & Safety)

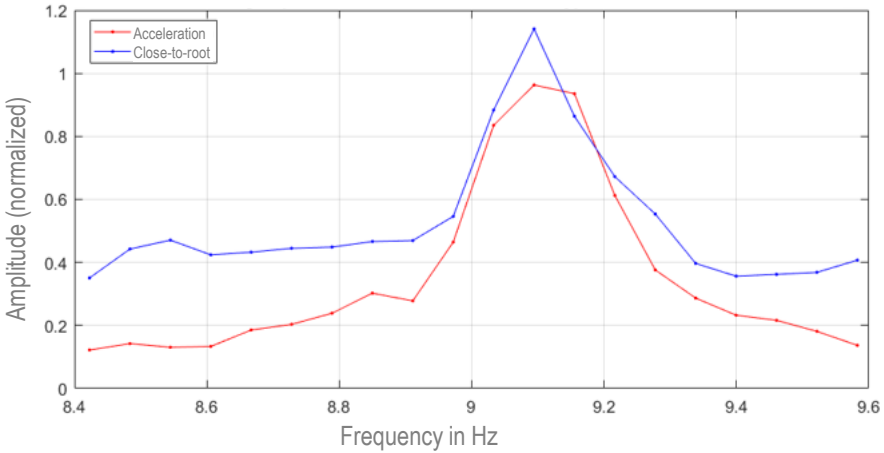
Acceleration sensors

- Installation: 1/3 of blade lengths
- Retrofittable

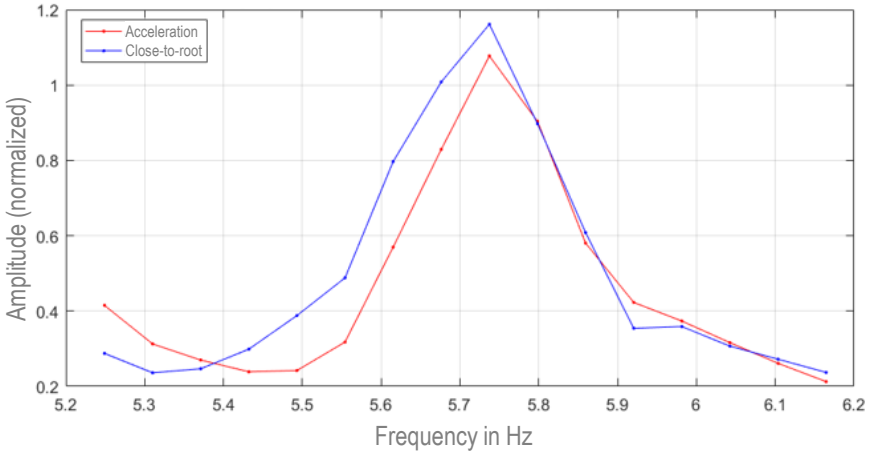
System variants for reliable ice detection

- Comparison of measured values of acceleration sensors & close-to-root sensors

edge-wise; turbine rotating; blade type: structural shell

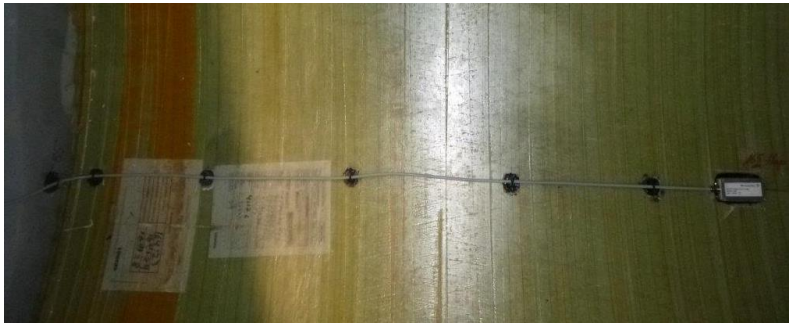


flap-wise; turbine in standstill; blade type: structural shell

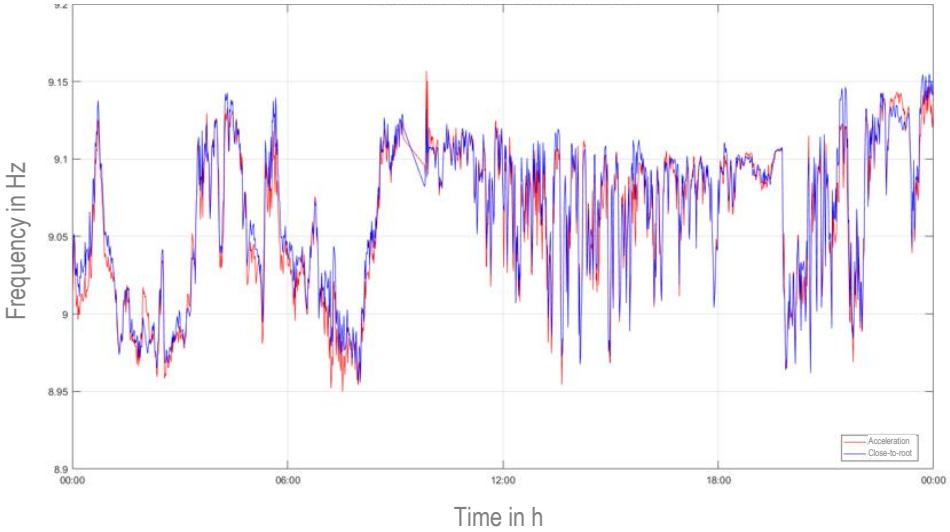


System variants for reliable ice detection

- Identical frequency ranges
- Reliable ice detection, even during standstill
- Same results for structural shell & beam blades



Frequency-response characteristic; turbine rotating; blade type: structural shell



Icing events at turbines

Weidmüller

- Evaluation of ice events at a turbine in northern Sweden per winter season

Winter season	Number of ice events > 1 h	Duration of standstill/heating in days
2013/2014	84	46
2014/2015	57	58
2015/2016	84	42
2016/2017	114	31
2017/2018	75	72
Average	**83 events**	**50 days**

Wind farm monitoring

- Comparative view of icing at a wind farm in Germany
- 5 h between first and last ice alert on turbines

Wind farm monitoring

- Comparative view of icing at a wind farm in Sweden
- 3 h between first and last ice alert on turbines
- 4.5 h between automatic restart of first and last turbine

Energy loss by heating without ice on the blades

Example calculation:

- Power consumption of hot air heating system: 60 kW per blade → 180 kW / turbine
- Average value from previous example: 2.5 h heating without ice on the blades
  - Energy consumption: 450 kWh / turbine
  - Costs (80 € / MWh): 36.0 € / turbine / ice event
- On average 83 ice events / winter season
  - Costs (80 € / MWh): 2,988 € / turbine / season

- Amortization of **BLADE**control® after approx. 3 years

Conclusions

- Reliable ice detection by close-to-root & acceleration sensors
- 50 days standstill/heating of turbines per winter season due to ice events in cold climate regions
- Different icing within a wind farm

- Downtimes due to ice reduce the availability
- Reduction of energy demand for heating system by shorter operation periods
- Reduce of yield loss due to early and detailed ice detection

Weidmüller

Thank you!

Weidmüller Monitoring Systems GmbH
Else-Sander-Straße 8
01099 Dresden, Germany
Fon: +49 351 213 916-50
monitoring.systems@weidmueller.com

Dr.-Ing. Daniel Schingnitz
Sales and Marketing WMS
T: +49 351 213 916 73
M: +49 163 331 86 68
daniel.schingnitz@weidmueller.com