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FAtigue MOnitoring System4Wind

Advanced Fatigue Solution for Industrial Assets, Like Wind Turbines, Subject to Cyclic Loading Conditions

The combination of vibration monitoring with progressive fatigue assessment methods and the utmost level of expertise extends the operational lifetime of industrial assets.

Challenge

Industrial assets (for example, wind energy turbines, distillation columns) are subject to loads inducing fatigue effects and hence increase the cumulative usage factor (CUF).

Fatigue is one of the main aging mechanisms. Despite the execution of regular maintenance, service or non-destructive testing (NDT), unexpected events during operation, such as equipment damage, leakages, and forced downtimes of entire systems may occur. A simple failure (crack, leakage or deformation) may lead to downtimes of entire systems. The performance of costly preventive maintenance, service or NDT at the right time with adequate efforts is a challenge.

Solution

Driven by high safety requirements and authority demands, **FA**tigue **MO**nitoring **S**ystem4Wind ensures high availability of monitored assets combining vibration monitoring with model based load estimation and utmost level of expertise.

Usage of the vibration monitoring system (accelerometers and angle sensors) allows lifetime analyses based on measured dynamic loads. Based on measured acceleration, the resulting displacements and stresses are calculated, and the remaining lifetime is determined.

Customer benefits

FAtigue MOnitoring System4Wind:

- Extends the operational lifetime of assets by realistic computation of CUF thanks to the combination of online vibration monitoring with model-based load estimation and utmost level of expertise
- Provides knowledge of the remaining lifetime which can be the basis for priority ranked maintenance
- Saves costs through asset lifetime extension (fewer replacements) and through increased asset availability
- Reduces the number of in-service inspections and maintenance
- **FA**tigue **MO**nitoring **S**ystem4Wind is part of the modular Advanced Fatigue Solution, AFS, which combines progressive fatigue assessment methods and high-accuracy load monitoring.

Application Examples

Wind energy turbines

Wind energy turbines are normally designed for a lifetime of around 20 years. A lifetime extension ensures cash profit. The knowledge of real loads and actual fatigue damage accumulation can be the basis for further operation. Combining acceleration measurements and the dynamical model of the wind turbine tower (mechanical structure) for an embedded monitoring system, allows to determine the remaining lifetime and fatigue damage using an online software solution with rain flow cycle counting. In addition, a trending of relevant parameters is done. Adequate maintenance programs are triggered by exceeding specific thresholds adhering to the principle “as much as necessary; as few as possible”.

Thermal power plant

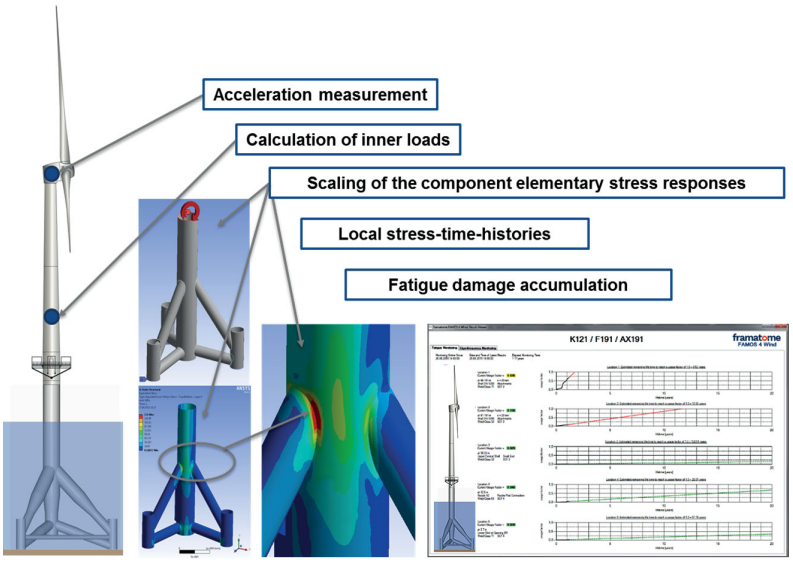
Components of thermal power plants are subject to cyclic thermo-mechanical loading conditions. Realistic load data are retrieved from transient temperature measurements nearby highly loaded components. The measured temperatures are the main input data for the determination of the local stress history at fatigue relevant locations of the component. Furthermore, the temperature history itself allows for conclusions regarding appropriate operation or possible disturbances such as leaking valves etc. As soon as the stress-time history is known, a cycle counting procedure is applied to identify fatigue cycles as the basis for a qualified (if required online) fatigue evaluation. Partial and total fatigue usage factors are determined in a straight forward way. Creep damages are also included, if required.

Your performance
is **our** everyday **commitment**

Key figures

35 years of experience and expertise in the field of structural health monitoring

45 local load monitoring systems and related fatigue assessment sold to thermal power plants

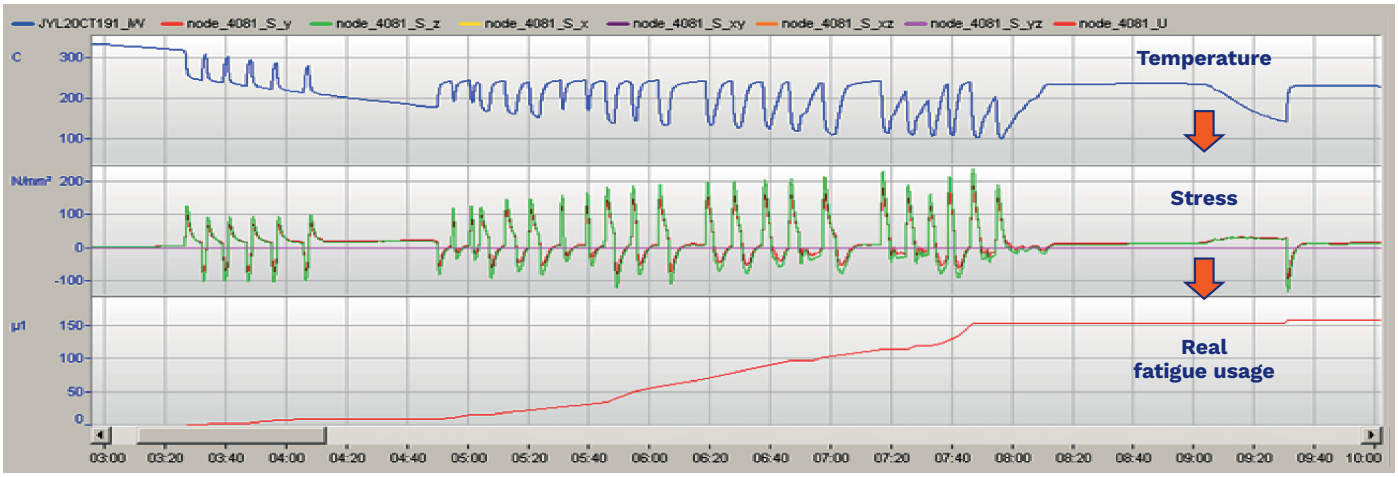


Application example: wind energy turbine

Technical information

The **FA**tigue **MO**nitoring **S**ystem4Wind monitoring system features:

- Scalability and time synchronization (e.g. easy expansion of number of channels)
- Digital and analog interfaces to SCADA or instrumentation and control systems
- Synchronous acquisition of static data (<100 Hz) and dynamic data (>1000 Hz)
- Online CUF calculation based on elementary loads and usage of the transient local six components stress tensor
- Integrated data storage, self-start after power failure and watchdog hardware and software
- Online / remote configuration and visualization tool, diagnostic and maintenance support
- Event detection, logging and notification
- Certified by the Germanischer Lloyd and compliance with ISO 7919, ISO 10816, ISO 13373, ISO 13374, ISO 13379, ISO 17359 and ISO 13381.



Example of a thermal power plant: measured load history like temperature → precise stress history → precise damage and CUF

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