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Abstract: As wind turbines grow larger and are erected at even more remote and inaccessible locations, service and maintenance costs can be reduced significantly, if the state of the turbine is monitored remotely (generally known as SCADA systems). However, this requires that the measurements retrieved from the turbines have a sufficient level of information value, i.e. that they are indicative for the state of the turbine and can be used for decision making in respect of service and maintenance.

With the rise of new innovative smart sensor technologies, based on e.g. piezo electrical materials, the cost and expected lifetime limits are moved significantly. The lower costs and longer lifetime available within the smart sensor technology motivates for fleet instrumentation. In combination with a model based filter, which has a sufficiently high order to support estimation of the dominating global dynamics of the turbine, a solution strategy for cost effectively providing online data of the structural states on a fleet of wind turbines is available. It is in general recognized that the overall structural state of the wind turbine is very indicative in respect of the accumulated loading on the wind turbine and the level of wear and tear on the sub-components – not only the gear box, but all main sub-components, as blades, hub, shaft, nacelle bed-plate, yaw-system, tower and foundation. Additionally, online knowledge of the overall dynamic state of the turbine facilitates load rate estimation and from this early stage warning about potential structural failure in contrast to present used sub-component monitoring systems which do not estimate loads but only act on direct structural changes.

The present project on OMA of wind turbines will support the development of more advanced online health monitoring systems for wind turbines by combining advancements within smart sensor technology as applicable in Wireless Sensor Networks with detailed structural and aerodynamic model based system identification techniques. The full project will outline a complete solution strategy for a new structural health monitoring system for wind turbines.

This project is a part of the EU project *System Identification, Condition and Health Monitoring for a New Generation of Wind Turbines (SYSWIND)* under the Marie Curie Initial Training Network Programme.

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