dti

PROJECT PROFILE NO PP218

Development of Prognostic/Health Management (PHM) Technologies for Wind Turbines

OBJECTIVES

- Develop technology which is capable of cost effectively providing prognostic information about the mechanical health of a wind turbine.
- Install the technology on a wind turbine, and establish normal "signatures" for the mechanical components, and their variation with operating conditions.
- Conduct an in-field trial to establish the variability of the data from different wind turbines, and any seasonal variability in the data.
- Demonstrate the use of Artificial Intelligence (AI) /model-based techniques to extract prognostic information from the data.

SUMMARY

The requirement to avoid unnecessary and nugatory maintenance becomes critical in the case of offshore wind turbine installations, given the difficulty of routine access. Prognostics and Health Management (PHM) technology could be used to remotely confirm fault conditions at the earliest stage, without the need for conventional methods of inspection, and with minimal false alarms. For offshore wind turbines in particular, there is a financial advantage in ensuring that any necessary maintenance can be predicted and then arranged to take place at the most convenient time, thus minimising the associated cost and outage time. PHM moves beyond conventional monitoring systems, adding the critical element of timescale to enable truly proactive maintenance methods to be implemented.

The current state of the art in Prognostics and Health Management (PHM) of rotor and gearbox systems of similar complexity to those used in wind turbines is to be found in helicopter HUMS (Health and Usage Monitoring Systems), which are dominated by

sophisticated, onboard vibration monitoring systems. Such systems are expensive to produce, install and maintain and are only justifiable in the context of the extraordinarily high costs of in-service helicopter failures.

This project will study an alternative approach which has the potential to avoid completely the use of conventional and expensive components. Previous work carried out by Avenca staff in the development of diagnostic systems for monitoring other forms of rotating machinery has indicated that this approach is sensitive to the presence of mechanical defects, as well as being obtainable without the costs associated with conventional forms of instrumentation.

This project aims to demonstrate the ability to monitor wind turbine health using inherently low cost and robust instrumentation, through the development and installation of a trial system on land-based wind turbines, and reviewing and analysing the data over a period of up to a year.

CONTRACTOR

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(Contract Number: W/52/00662/00/00)
URN Number 05/1226

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COST

The total cost of this project is £143,170, with the Department of Trade and Industry (DTI) contributing £107,380, and Avenca Limited the balance.

DURATION

21 months – February 2005 to October 2006.