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預兆式離岸風機營運維修系統之開發(3/3)

The development of a Prognostic Operation and Maintenance System of Offshore Wind Farm(3/3)

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摘要

本研究預定以三年的時間針對離岸風機的整體性能、葉片結構性能及葉片噪音開發預兆式診斷與健康管理演算法及線上程式。由於國內尚未有離岸風機的建置，本研究將考慮風機正常/異常操作與葉片有/無損壞條件下運作，以數值計算的方式，提供離岸風機流場、風機性能、葉片結構性能及葉片噪音的計算結果，供預兆式診斷與健康管理的演算法訓練與驗證使用，預兆式診斷與健康管理的健康評估結果將提供為風場進行風機營運維修的決策依據。本研究針對風機整體性能開發高斯混合模型、自組織地圖法及倒傳遞類神經網路等三種預兆式演算法預估風機的剩餘有效壽命，使用流固耦合計算法計算風機流場、馬力性能、塔架及葉片受力及葉片噪音，開發用麥克風偵測葉片噪音來診斷葉片損傷的方法。本研究與上緯股份有限公司成立的海洋風力發電公司、東元風機事業處及台電再生能源處合作研究。

本研究第三年依規劃進度完成以下五項研究工作：

1. 將風機的健康指標及其健康趨勢與 IEC61400-25 監控程式結合。
2. 線上 PHM 系統之風機性能預測建置完成。
3. 實際風機葉片疲勞壽命之預測。
4. 風機於額定操作狀態之氣動力數值模擬以及噪音模擬分析。
5. 建立判斷正常與異常風機之判斷指標臨界值與完成移動式現場量測之指標計算系統。

關鍵詞：離岸風機、預兆式診斷、智慧維護。

Abstract

An online program of prognostics and health management, focus on the total performance, tower structure, blade structure and blade noise of the offshore wind turbine, will be developed in this study. The numerical calculation data for the normal and abnormal operation and damaged and non-damage of the blade structure, power performance, and noise of offshore wind turbine will be used for the training and validation of the developing prognostics and health management program. The outcome of the prognostics and health management program will be the basis for making the decision of the operation and maintenance of offshore wind farm. The Gaussian mixture model, self-organization map and backward propagation neural network method were developed for the prediction of remaining useful life of wind turbine. The fluid-structure coupling numerical method was developed for the calculation of the flow field, power performance, the stress of the tower and blade and blade's noise of wind turbine. The blade diagnosing method by using the noise generated by the wind blade was also developed for the damage detection of wind turbine blades. The Formosa Wind Generation CO., LTD. funded by Swancor IND. Co., Ltd TECO Electric and machinery Co., Ltd. and the department of renewable energy of Taiwan Power Company are the partners of this research.

Following the planned schedule, the five research topics were completed in the third year:

1. To Integrate the health index of wind turbines into IEC61400-25 monitoring program.
2. To establish the performance prediction of wind turbines in the online PHM system.
3. To predict the fatigue life of an actual wind turbines.
4. To conduct the numerical simulation on aerodynamics performance and noise of the wind turbine blades under normal operation.
5. To establish the threshold for identifying the abnormal wind turbines and index calculation system by mobile on-site measurement.

Keywords: Offshore Wind Turbine, Prognostic Method, Intelligent Maintenance.