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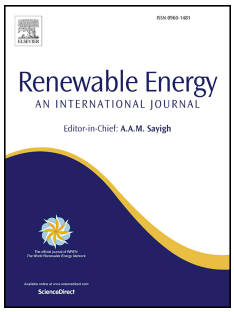

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M.A. Djeziri, S. Benmoussa, R. Sanchez

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Hybrid Method for Remaining Useful Life Prediction in Wind Turbine Systems

M.A. Djeziri[a], S. Benmoussa[b], R. Sanchez[c]

[a]*LSIS, UMR CNRS 7296, Avenue Escadrille Normandi Niemen, 13397 Marseille, France.*
[b]*LASA, Badji-Mokhtar Annaba University, BP* 12*, 23000 Annaba,Algeria*
[c]*Facultad de Ingenieria Electrica, Universidad Michoacana de San Nicolas de Hidalgo, 58000 Morelia, Mexico.*

Abstract

This paper deals with fault prognosis of wind turbine in presence of multiple faults. First, a physical model is presented and used for structural analysis, sensor placement, and clusters generation characterizing the normal operation and the relevant faulty situations. Then, each cluster is surrounded by a spherical envelope to take into account modeling and parameter uncertainties. To perform fault prognosis, the geolocation principal is used to predict the Remaining Useful Lifetime, where the Euclidean distance between normal and faulty clusters, the degradation direction and velocity are calculated. The obtained results, using real wind data, are evaluated using the Prognosis Horizon and the Relative Accuracy metrics.

Keywords: Wind Turbine, Fault Prognosis, Fault Diagnosis, Clustering, Bond Graph Modeling.

1. Introduction

The first fully automated wind turbine designed to generate electricity was developed in 1887. Since then, wind technology has been continuously evolv-

Email addresses: mohand.djeziri@lsis.org (M.A. Djeziri), amin.benmoussa@univ-lamaba.dz (S. Benmoussa), rtsanchez@dep.fie.umich.mx (R. Sanchez)