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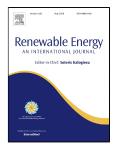
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#### ACCEPTED MANUSCRIPT

# Wind farm monitoring using Mahalanobis distance and fuzzy clustering

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#### 6 Abstract

- 7 This paper proposes an approach for warnings and failures detection based on fuzzy
- 8 clustering and the Mahalanobis distance. Both techniques are developed in a real wind
- 9 farm for critical devices typically found in a wind turbine. A power curve is modelled
- using fuzzy clustering and parametric fitting techniques in a first step. Then, warnings
- and alarms recorded by a Supervisory Control and Data Acquisition system are analysed
- from their locations and distances to the curve. The Mahalanobis technique is selected for
- this purpose and its accuracy is validated with other methods considered. The research
- 14 reveals the existence of zones with complex detectability for some winds speed and
- powers ranges. However, in contrast to a standard pattern, there will be differences in
- terms of distances. The usefulness of the findings lies in the inclusion of a real-time
- monitoring system applying easily available resources. The paper is understood as a
- complement to other specific and costly monitoring systems to ensure the implementation
- of actions before the occurrence of a failure. A large number of publications using the
- 20 power curve can be found focusing on forecasting or market researches, but this trend is
- 21 not usually extended to the wind turbine maintenance management.
- 22 Key words: Wind turbine, power curve, supervisory control and data acquisition,
- 23 Mahalanobis distance, fuzzy clustering.

#### 1. Introduction

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- In such an evolving environment where climate change is a fact and environmental
- involvement is understood as a need, clean energies emerge as the best alternative to the
- traditional energy generation [31][33]. However, their growth in recent years remain a
- challenge, despite the constant efforts of companies for a continuous improvement [32].

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