Modal Identification of a Wind Turbine Before and After the Extension of the Blades

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Abstract

The paper describes the study of the dynamic properties of a 1,3 MW wind turbine Izar Bonus 62 using two different measurement types: accelerations and strains. The blades of this wind turbine were fitted with 1,5 m extensions with the purpose of increasing the wind turbine's swept area enabling it to capture further wind energy.

The main objective of the study was to identify the modal properties of the rotor and tower (natural frequencies, damping ratios and mode shapes) before and after the extension of the blades in order to compare with the results from numerical analysis and to evaluate the possibility of appearance of resonance problems. With this purpose, ambient vibration tests and a rotor-stop test were conducted and the results obtained before and after the extension were analyzed in order to validate the adequate performance of the wind turbine after extension of the rotor blades.

Keywords: Rotor blade extension; wind turbines; modal identification.

1 Introduction

The planning of wind energy investments is developed assuming both wind conditions at site, which may be compromised if these conditions are overestimated, and available technology. In cases where technology is clearly outdated or the wind resource is clearly underused, an increase of the rotor diameter can be a solution to increase the power energy output of the turbine. However, since wind turbine structures are highly dynamic systems, interventions in the rotor blades may modify the dynamic characteristics of the structure and contribute to reduce the life time of the turbine. In that sense, structural modifications must be carefully studied and the numerical results must be confirmed by experimental tests.

This paper presents the study of the dynamic properties of a 1,3 MW wind turbine Izar Bonus 62, conducted by the Laboratory of Vibrations and Structural Monitoring (ViBest/FEUP) in collaboration with INEGI as part of a rotor blades extension (RBE) project led by Energiekontor [1]. The increase in length obtained was of 1,5 m per

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