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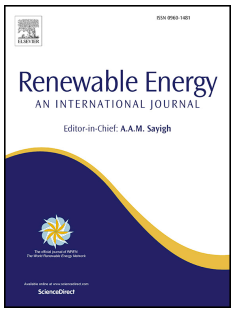

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Small Wind Turbines: a Numerical Study for Aerodynamic Performance Assessment under Gust Conditions

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Abstract

In the present work, a numerical study aimed to analyse the effect of an extreme loading event on a Horizontal Axis Wind Turbine (HAWT) is performed. A 3D unsteady CFD model of the NREL *Phase VI* small-sized wind turbine is validated against experimental data, with the incompressible solver of ANSYS Fluent and an unstructured moving mesh strategy. Then the Extreme Operating Gust (EOG) model from IEC 61400-2 is considered as the inlet condition. The results of the aerodynamic response and of the structural ultimate check, based on the IEC guidelines, are presented for both the operating and the parked turbine, in order to underline the benefit of the safety position in terms of lower stress transferred to the critical root section.

Keywords: Wind gust, Unsteady CFD, HAWT, NREL Phase VI, IEC 61400-2

Nomenclature

A $[-]$	Section area	F_z $[kN]$	Axial load
c $[m]$	Chord length	$F_{z,max}$ $[kN]$	Maximum axial load
c_p $[-]$	Pressure coefficient	I $[-]$	Turbulent intensity
C $[-]$	Courant number	m $[kg]$	Mass
D $[cm]$	Root diameter	M $[Nm]$	Torque

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