شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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HANAA ALY

BLADE CAMBER EFFECTS ON VERTICAL AXIS WIND TURBINES PERFORMANCE

By

Basem Moheyeldin Helmy Abotaleb

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Aerospace Engineering

FACULTY OF ENGINEERING ,CAIRO UNIVERSITY
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Title of Thesis:

BLADE CAMBER EFFECTS ON VERTICAL AXIS WIND TURBINES PERFORMANCE

Key Words:
VAWT, Turbulence Modeling, Flow curvature, Virtual camber

Summary:
Blade camber effects on the performance of the H-Darrieus rotor is studied. RANS model was solved using commercial CFD package ANSYS-FLUENT. The numerical results revealed that the negatively cambered airfoil is not a suitable option for practical VAWT. Results also shows that the effect of using adequate time step and convergence criteria is crucial to produce results that are in a close match with experimental results.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Basem Moheyeldin Helmy Abotaleb | Date: ../../2021

Signature:

Dedication

To my father and mother.

and,

To the good people who did not despair to continue the march despite its difficulty.
To those who have not given up their dreams because they are difficult to achieve.
To those who paid the price of their dreams with their ages.
To those who was not lucky enough to find the paved way.
To those who do not stop when they hear "you cannot".

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Symbols

2D	two dimensional
c	chord length $[m]$
C_P	wind turbine power coefficient
C_{press}	pressure coefficient
C_T	wind turbine torque coefficient
D	turbine diameter$[m]$
D_{RR}	rotating domain diameter $[m]$
F	external body force
g	gravitational body force
I	unit tensor
λ	tip speed ratio,ΩRU_∞ [-]
μ	molecular viscosity
N	blade number
Ω	rotational speed of the turbine $[s^{-1}]$
P	static pressure$[\frac{N.m}{m^2}]$
$\overline{\overline{\tau}}$	stress tensor
P_{blades}	power generated by the turbine blades
P_{brake}	measured power
$P_{parasite}$	parasitic power
P_W	total aerodynamic power (ideal) going into turbine
R	turbine radius $[m]$
ρ	fluid density
Re	Reynolds number
ρ	air density $[\frac{kg}{m^3}]$
σ	turbine solidity
t	time [sec]
T	torque per unit length $[\frac{N.m}{m}]$