

CONSTRUCTION AND PERFORMANCE ANALYSIS OF SAVONIUS VERTICAL AXIS WIND TURBINE

This thesis paper is submitted to Department of Mechanical Engineering, Sonargaon
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We, Md Atikur Rahman, Md. Bellal Sharif, Md. Rubel Hossain And Sabrina Akter Sumi declare that this thesis titled, “**CONSTRUCTION AND PERFORMANCE ANALYSIS SAVONIUS VERTICAL AXIS WIND TURBINE**” and the work presented in it are our own and has been generated by us as the result of my own original research.

We confirm that:

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3. Where we have consulted the published work of others, this is always clearly attributed.
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5. We have acknowledged all main sources of help.
6. None of the part of this work has been published before submission.

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ABSTRACT

In the current age of global energy crisis, the production of energy through alternate energy resources has gained a significant attention. Wind as a source of energy is a very attractive due to the fact that fuel is free of cost in this case. This research is about the design of a VAWT blade using the analytical and CFD (Computational Fluid Dynamics) techniques for a small scale vertical axis wind turbine (VAWT), aiming 04 Volt power output which may be use for domestic purposes to power a single room. The blade design parameters and dimensions are taken aiming the required power output and analytical models are developed to evaluate the aerodynamic forces like lift and drag over the surface of the blade. These forces which are very helpful for the evaluation of the structural integrity of the VAWT blade are then found to be in a close agreement with CFD results which are simulated using commercial software, solid works. The static CFD model is developed at a selected pitch angle during a complete 360° where the aerodynamic forces evaluated are comparable with the analytical values at the similar location.

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NOMENCLATURE

Symbol	Description	Unit
A	Swept area	m ²
C _d	Coefficient of drag	
C _p	Coefficient of power	
C _t	Coefficient of torque	
D	Rotor diameter	m
F	Force	N
F _w	Wind force	N
H	Rotor height	m
I	Current	A
P _a	Power available	watt
u _∞	Free stream velocity	m/s
U	Wind speed	m/s
n	Number of blades	
P _{active}	Active electrical power generated	watt
P _t	Turbine power	watt
P _{total}	Total electrical power	watt
P _w	Wind power	watt
r	The radius of semi-circular section of rotor	m
T	Torque	N-m
R	Rotor radius	m
R _l	Load resistance	Ohm
R _s	Stator resistance	Ohm
W	Weight of blade	Kg

T_{Base}	Rated Torque	N-m
T_p	End plate thickness	m
t	Blade thickness	m
V_{rotor}	Velocity of rotor	m/s
α	Angle of attack	rad
$\rho \lambda$	Free stream density	kg/m ³
λ_r	Tip speed ratio, m	
\square	Rotor flux linkage	
	Maximum shear stress	N/mm ²

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