DESIGN AND OPTIMIZATION OF AFFORDABLE WIND TURBINE BLADE GEOMETRY FOR A HORIZONTAL AXIS WIND TURBINE UNDER LOW SPEED WIND CONDITIONS

By

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

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The main objective of the project is to design a small wind turbine generator of 500W. This paper presents a design and optimization of a three bladed horizontal axis wind turbine with a radius of 3.5 m for low wind speed conditions of 4 m/s. The blade configuration is made to be as simple as possible in order to make it affordable. The simulation is done using open source Computational Fluid Dynamics (CFD) software OpenFOAM. The simulation uses a solver called simpleFoam based on the Reynolds Averaged Navier-Stokes (RANS) with k-ω turbulence model. The optimization study was conducted by changing parameters of the width of the blade chord, inner tip angle and using a chambered airfoil. The optimization of the power produced a maximum efficiency of 40% of the kinetic energy in the wind. A prototype was then made to be combined with a buoyant device to make an airborne wind turbine.

Keywords: Small scale wind turbine, optimization blades, CFD analysis, airborne wind turbine

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DEDICATION

I would like dedicate this thesis work for my parents, Chandra Irawan and Florence Atmadi, my sister, Grace Monica and Lexy.

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