# HORIZONTAL AXIS WIND TURBINE ROTOR DESIGN AND ANALYSIS

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"I declared that this thesis is the results of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree."

Signed: .....

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## ABSTRACT

`An innovative horizontal axis wind turbine, (HWAT) which is the rotor blades are attached with springs was designed and fabricated (3 blades HWAT). The project is started with literature review in HWAT scope, in kinematics of spring and also the rotor design which is based on NACA 0020. It is continued with the analysis on the dimensional analysis of the wind turbine where the Reynolds number and Mach number similarity are applied. After that, the rotor is fabricated based on NACA 0020 using CNC machine model while the turbine hub is fabricated similar to HWAT design model.

The wind tunnel testing is conducted in Low Speed Wind Tunnel Open Circuit type with a 50 mm x 50 mm test section located at Aerospace Laboratory, Faculty of Mechanical Engineering, UiTM Shah Alam. The experiment is done in 2 ways, one with rotating wind turbine and another one is in static condition. The reason why the wind turbine is placed static is to predict whether the function of the spring is working or not. By the way, when the turbine is static, the flow characteristics such as drag and moment coefficient also can be compared to the rotating wind turbine. When it is rotating, the angle of attack is set to be around $20^0$. This is because a few criteria must be fulfilled before stall phenomena can take place at $14^0$ (NACA 0020).

The data obtained from the experiment done will be used in calculation and analysis to determine the drag coefficient for both conditions (static and rotating). From these result, several graphs will be plotted and discussed. Lastly, the recommendation to improve this project and future research are jotted down together with conclusion.

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