Nuttapol Lakonchai 2012: A Study of Flow over Vertical Axis Wind Turbine. Master of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Associate Professor Chawalit Kittichaikarn, Ph.D. 102 pages.

Aerodynamics of flow over Vertical Axis Wind Turbine (VAWT) is inherently unsteady and beyond the limits of classical airfoil theory. However, a prediction of the unsteady flow using recent developments in computational methods is capable to increase the understanding of VAWT aerodynamics. The purpose of this paper is to analyze the VAWT's behavior and investigate the optimum operating condition for the best performance of this wind turbine using commercial computational fluid dynamics (CFD) program. A CAD model of this VAWT was created by using reverse engineering process. The simulation was performed at different constant rotational speeds on the turbine for a certain approaching wind speed to evaluate the power coefficients (Cp) as a function of a tip speed ratio (TSR). A moving mesh technology was used to investigate a change in flow field at a particular time step in two dimensional flows around wind turbine blades. The RNG k-epsilon model with standard wall function was adapted for the turbulence closure. To validate this model, it was then used to perform the analysis of air flow over the NACA0012 turbine blades. The computational lift forces agreed well with those obtained from experiments performed by Kirke (1998), for the angles of attack between –15 and 15 degree. The torque from the simulation was used to obtain the correlation between the coefficient of power (Cp) and tip speed ratio (TSR). From the result, it was found that this VAWT has maximum coefficient of power at approximately 2-2.5 tip speed ratio.

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