

Abstract Submitted
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Numerical Investigation of Capability of Self-Starting and Self-Rotating of a Vertical Axis Wind Turbine¹ HSIEH-CHEN TSAI, TIM COLONIUS, California Institute of Technology — The immersed boundary method is used to simulate the incompressible flow around two-dimensional airfoils at low Reynolds numbers in order to investigate the self-starting and self-rotating capability of a vertical axis wind turbine (VAWT) with NACA 0018 blades. By examining the torque generated by a three-bladed VAWT fixed at various orientations, a stable equilibrium and the optimal starting orientation that produces the largest torque have been observed. When Reynolds number is below a critical value, the VAWT oscillates around a stable equilibrium. However, the VAWT goes into continuous rotation from the optimal orientation when Reynolds number is above this critical value. It is also shown that VAWT with more blades is easier to self-start due to a wider range of positive starting torques. Moreover, with a proper choice of load model, a VAWT is able to self-rotate and generate a designed averaged power.

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