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Numerical Study for Detailed Flow Fields and Performance of the Savonius-Type Rotor TONG ZHOU, DIETMAR REMPFER, IIT, Chicago — The Savonius-type rotor is simple in structure, has good starting characteristics, relatively low operating speeds, and an ability to accept wind from any direction, although it has a lower efficiency than other vertical axis wind turbines. So far a number of experimental investigations have been carried out to study the performance of the Savonius rotor, however, there is a lack of detailed descriptions of the flow field. The aim of this paper is to numerically explore the non-linear two- dimensional unsteady flow over a Savonius rotor and develop a simulation method for predicting its aerodynamic performance. The simulations are based on Star CCM+. The motion of the blades is solved by using a moving mesh. Different turbulence models are compared. Parameters such as mesh density, wall y^+, and boundary conditions will be discussed. Numerical simulation results are compared with experimental data. Separation of the flow at the blade tips is well modeled. The characteristics of flow fields details are studied, including boundary layer, moment coefficient, and pressure distribution. The wall shear on each surface of the blades is studied to look into the position of the separation point. Computational fluid dynamics is proven to be an effective approach for the investigation of the Savonius-type rotor, on the premise of proper theory and reasonable assumption. It also provides a basis for optimization of the Savonius wind turbine.

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