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Blade-Wake Interactions in a Vertical Axis Wind Turbine¹ SANG-WOO AHNN, Seoul National University, HYEONGMIN KIM, Hyundai Motor Company, SEHYEONG OH, HAECHEON CHOI, Seoul National University — We investigate the flow characteristics of a vertical axis wind turbine (VAWT) and its aerodynamic performance using large eddy simulation with an immersed boundary method. The VAWT considered in this study consists of three blades, and the Reynolds number is 80,000 based on the rotor diameter and free-stream velocity. The simulation results show that each blade interacts with the wakes generated by the preceding blade and also by itself in the downwind region. To examine the effect of these blade-wake interactions on the aerodynamic performance, we simulate the flows with one blade only and with two blades, respectively. The blade performance significantly deteriorates in the upwind region due to the wake induced by the preceding blade. In the downwind region where the blade performance is poor, each blade interacts with its own wake and the wake from the preceding blade, but these blade-wake interactions rather improve the aerodynamic performance of each blade. As the tip speed ratio increases, the preceding blade highly influences the performance of the following blade, but does not much on the second following blade.

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