

Abstract Submitted
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Control of flow past a vertical axis wind turbine at low tip speed ratio by a bio-inspired device¹ SANGWOO AHNN, Seoul National University, HYEONGMIN KIM, Hyundai Motor Company, HAECHEON CHOI, Seoul National University — We investigate the flow characteristics of a vertical axis wind turbine (VAWT) and control the flow with a bio-inspired device using large eddy simulation. The device is a passive control device inspired by the secondary feather of a bird, called automatic moving deflector (AMD) by Kim et al. (2016, Bio & Bio). The performance of a VAWT is improved in the range of tip speed ratio below 1.2 when AMD is applied to the inner surface of each blade. The AMD automatically pops up when the leading edge separation occurs in the upwind region. As a result, the relative location of the leading edge vortex with respect to the blade is changed. The effect of its position is considered at the tip speed ratio of 0.8. When AMD is located near the leading edge of the blade, it alters the path of the leading edge vortex towards the front part of the blade. The low pressure region due to this vortex enhances the tangential force in the direction of rotation, thus increasing the torque and power coefficient. On the other hand, the power loss increases due to AMD after the leading edge vortex detaches from the blade. Overall, the power coefficient increases with AMD.

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