

Development of a New Blade Profile for a Vertical Axis Wind Turbine

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Abstract

The vertical axis wind turbine design depicted in (Fig.1) is widely considered a wind turbine of a wind power generation system because it can be easily miniaturized, it generates low noise, and it rotates regardless of wind direction. The vertical axis wind turbine has, however, low rotation performance when compared with that of a horizontal axis wind turbine. Therefore, we need to improve the rotation performance of the vertical axis wind turbine. This study proposes a new blade shape of a vertical axis wind turbine effective for a wide range of wind speed. A proposed new blade profile has largely rounded leading and trailing edges, see Fig. 2. Performance of this new blade was first simulated by COMSOL Multiphysics® using the CFD module. Some examples of simulated pressure distribution are shown in Fig. 3. Simulated results were then confirmed by wind tunnel experiments. As shown in Fig. 4, results obtained by numerical simulation and wind tunnel experiments are in good agreement. These results suggested that a proposed new blade profile has higher performance when compared with a conventional blade profile.

Figures used in the abstract



Figure 1: Vertical axis wind turbine (Actual machine in Ritsumeikan univ.)

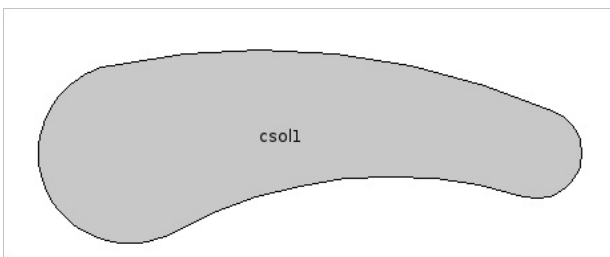


Figure 2: Proposed new blade profile.

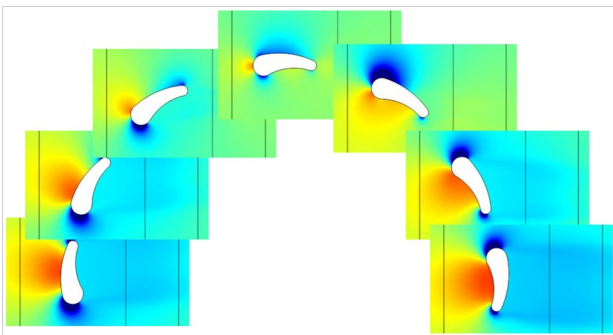


Figure 3: Example of simulated pressure distribution by COMSOL.

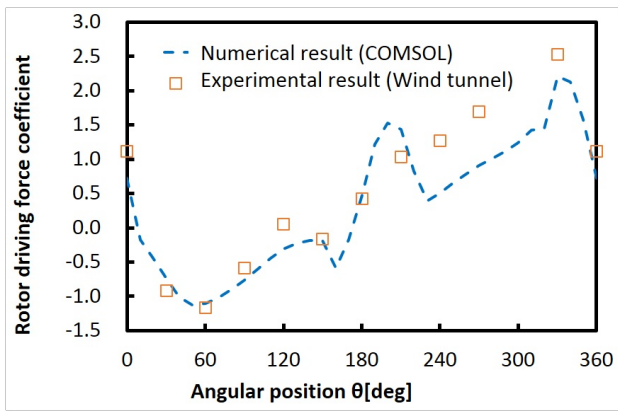


Figure 4: Calculated rotor driving force.