

Experimental and Numerical Studies on the Wake behind Rotor Blade

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Summary

The wake behind rotor blade is investigated by numerical and experimental approaches. Flow structure measured through PIV is compared with numerical analysis using commercial program of ANSYS CFX adopting the RNG k- ϵ turbulence model. Blade model fabricated by Rapid-Prototype method has the cross section of NACA0012 airfoil and the pitch angle of 10° . The rectangular blade of which rotating diameter (D) and chord length are 0.12 m and 0.024 m respectively rotates at 240 rpm. Horizontal and vertical directions of the blade are selected as x and z coordinates, respectively, the origin locates at the rotating center, and measurement range is 256×205 mm². PIV measurements were carried out at 12 phase angles with the interval of 15° in the range from 0° to 180° . The wake flow behind the rotor blade and pressure distributions on the blade are easily visualized in the numerical computation. The experimental results showed that asymmetric tip-vortex was generated in the wake around $z/D=0.5$ and the vertical velocities reached their highest level at the phase angle of 0° . Also, it is confirmed that the result of numerical analysis is in good agreement with the experimental one in term of the vortical structure.

keywords: Rotor blade, PIV(Particle Image Velocimetry), Phase angle, Tip vortex

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