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Modeling rotor wakes of a quadrotor UAV in hovering mode¹ SEUNGCHEOL LEE, HUNGSUN SON, JOOHA KIM, Ulsan National Institute of Science and Technology, UNIST, Korea — For rotary-wing aircraft, predicting the locations of the rotor-tip vortices plays an important role in determining the rotor performance. Thus, there have been various attempts to model the rotor wake geometry for a single rotor. However, when these models are applied to multirotor UAVs, the interaction between rotor wakes, such as wake deflection, cannot be modeled. In the present study, we develop an empirical model that can predict the wake geometry for a quadrotor UAV in hover. The experiment is performed in a chamber at Re = 34,000, where Re is the Reynolds number based on the rotor chord length and the rotor-tip speed. By varying the normalized rotor separation distance (d/D) from 0.06 to 1.18, we directly measure the thrust force and the velocity field in the rotor wake using PIV, where d is the distance between adjacent rotor tips and D is the rotor diameter. With decreasing the normalized rotor separation distance, the extent of rotor-rotor interaction increases, and thus the wake center moves more to the center of UAV as the wake develops downstream. The wake geometry is predicted by modeling the locations of the wake center and the wake diameter as functions of the normalized rotor separation distance. Details will be discussed in the presentation.

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