Abstract Submitted for the DFD17 Meeting of The American Physical Society

Effects of superhydrophobic surface on the propeller wake¹ HONGSEOK CHOI, JUNGJIN LEE, HYUNGMIN PARK, Seoul National University — This study investigates the change in propeller wake when the superhydrophobic surface is applied on the propeller blade. The propeller rotates in a quiescent water tank, facing its bottom, with a rotational Reynolds number of 96000. To measure the three-dimensional flow fields, we use stereo PIV and a water prism is installed at the camera-side tank wall. Two cameras are tilted 30 degrees from the normal axis of the tank wall, satisfying schiempflug condition. Superhydrophobic surface is made by coating hydrophobic nanoparticles on the propeller blade. Measurements are done on two vertical planes (at the center of propeller hub and the blade tip), and are ensemble averaged being classified by blade phase of 0 and 90 degrees. Velocity fluctuation, turbulent kinetic energy, and vorticity are evaluated. With superhydrophobic surface, it is found that the turbulence level is significantly (20-30%) reduced with a small penalty (less than 5%) in the streamwise momentum (i.e., thrust) generation. This is because the cone shaped propeller wake gets narrower and organized vortex structures are broken with the superhydrophobic surfaces. More detailed flow analysis will be given.

 $^1\mathrm{Supported}$ by NRF (NRF-2016R1C1B2012775, NRF-2016M2B2A9A02945068) programs of Korea government

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Date submitted: 28 Jul 2017 Electronic form version 1.4