Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Flow structures around a beetle in a tethered flight[1] BOOGEON LEE, SEHYEONG OH, HYUNGMIN PARK, HAECHEON CHOI, Seoul National University — In the present study, through a wind-tunnel experiment, we visualize the flow in a tethered flight of a rhinoceros beetle using a smoke-wire visualization technique. Measurements are done at five side planes along the wind span while varying the body angle (angle between the horizontal and the body axis) to investigate the influence of the stroke plane angle that was observed to change depending on the flight mode such as hovering, forward and takeoff flights so on. Observing that a large attached leading-edge vortex is only found on the hindwing, it is inferred that most of the aerodynamic forces would be generated by hindwings (flexible inner wings) compared to the elytra (hard outer wings). In addition, it is observed to use unsteady lift-generating mechanisms such as clap-and-fling, wing-wing interaction and wake capture. Finally, we discuss the relation between the advance ratio and Strouhal number by adjusting free-stream velocity and the body angle (i.e., angle of wake-induced flow).

[1]Supported by a grant to Bio-Mimetic Robot Research Center Funded by Defense Acquisition Program Administration, and by ADD, Korea (UD130070ID).

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Date submitted: 30 Jul 2017 Electronic form version 1.4