Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Massively parallel free-flight simulations of a passive bumblebee in turbulence[1] THOMAS ENGELS, ISTA, Tech.Univ. at Berlin & LMD-CNRS, Ecole Normale Supérieure, DMITRY KOLOMENSKIY, CEIST, Japan Agency for Marine-Earth Science and Technology , KAI SCHNEIDER, Inst. de Mathématiques de Marseille, I2M-CNRS, Aix-Marseille Univ. , MARIE FARGE, CNRS-INSMI, LMD-IPSL, Ecole Normale Supérieure-PSL, FRITZ LEHMANN, Department of Animal Physiology, Universität Rostock, JÖRN SESTERHENN, ISTA, Tech. Univ. at Berlin — High-resolution direct numerical simulations of a flapping bumblebee in fully developed turbulence are presented. The model insect is considered in free flight with all six degrees of coupled to the fluid solver. We study the influence of inflow turbulence with varying intensity on the passive response of the animal. The passive response is relevant for insects due to the finite reaction time after which changes in orientation are transduced into changes in the wingbeat kinematics. The impact on the cycle-averaged aerodynamical forces, moments and power consumption is assessed. We also analyze the leading edge vortex at the insect wings, which enhances lift production, and show that even strong inflow turbulence is insignificant for its flow topology in an ensemble-averaged sense. Orthogonal wavelet decomposition quantifies the scale dependence of the generated swirling flow and its intermittency.

[1]Financial support from the ANR (Grant 15-CE40-0019) and DFG (Grant SE 8246 - 1), project AIFIT, is gratefully acknowledged and CPU time from the supercomputer center Idris in Orsay, project i20152a1664.

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Date submitted: 31 Jul 2017

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