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Flight performance of autonomous quadrotors in von Karman wakes KASEY LAURENT, JOSHUA SOLBERG, MARIGOT FACKENTHAL, GRACE DING, GREGORY BEWLEY, Cornell University — Natural environments are highly variable and present significant challenges for autonomous aircraft. As the size of aircraft decreases, they become more susceptible to flow disturbances and typical control schemes fail. An understanding of the effects of turbulence on flight becomes crucial when developing new control schemes to optimize the performance of smaller aircraft. We designed an experiment in which an autonomous controller flies a small quadrotor in the von Karman vortex street behind a cylinder in a wind tunnel. We varied controller parameters as well as properties of the flow, such as mean airspeeds up to 3 m/s and wake dimensions as well as flow time scales between 0.5 and 2 times the quadrotor dimensions and response times, to find relationships between the controller and the response of the quadrotor. We measured displacements and power consumption in flight in the wake and compared this to the performance of the quadrotor in quiescent flow. Finally, we compare to the behavior of the quadrotor in active grid turbulence, with turbulence intensities up to 26%. We find that the quadrotor dynamics are set by an interplay between the turbulence and the controller.

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