Numerical simulation of the auto-rotation of a winged seed

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Winged-seeds, or *samaras*, as they are usually called, are seeds from different tree species which start auto-rotating as they fall from the tree. Thanks to this auto-rotating motion, samaras are able to decrease their descend speed so as to take advantage of lateral wind gusts to disperse over large areas.

This phenomenon is produced due to the coupling between the inertia properties of the seeds and the aerodynamic forces. This makes the problem non-linear and very interesting to study. Moreover, recent research (Lentink *et al.*, 2009) showed the existence of a strong and stable vortex above the seeds as they auto-rotate. This kind of vortical structures are also present in the flapping flight of insects, birds and bats and are of interest for the development of small micro air-vehicles (MAV).

Therefore, we perform direct numerical simulations (DNS) to solve the Navier-Stokes equations coupled with the rigid-body equations of motion of a winged seed to study its auto-rotational flight. Apart from identifying the vortex that develops above the seed, we also investigate the effect that changing the Reynolds number has on the fluid and on the kinematics of the seed.