Free falling ad rising of spherical and angular particles

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Direct numerical simulations of freely falling and rising particles in an infinitely long domain, with periodic lateral boundary conditions, are performed. The focus is on characterizing the free motion of cubical and tetrahedral particles for different Reynolds numbers, as an extension to the well-studied behaviour of freely falling and rising spherical bodies. The vortical structure of the wake, dynamics of particle movement, and the interaction of the particle with its wake are studied. The results reveal mechanisms of path instabilities for angular particles that are different from those for spherical ones. The rotation of the particle plays a more significant role in the transition to chaos for angular particles. The balance of forces and torques acting on particles is discussed to gain more insight into path instabilities of angular particles.