Abstract Submitted
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Aref's chaotic orbits tracked by a general ellipsoid using 3D numerical simulations PEI SHUI, School of Engineering, The University of Edinburgh, UK, STÉPHANE POPINET, Institut Jean le Rond dAlembert Université Pierre et Marie Curie, France, RAMA GOVINDARAJAN, TIFR Centre for Interdisciplinary Sciences, Hyderabad, India, PRASHANT VALLURI, School of Engineering, The University of Edinburgh, UK — The motion of an ellipsoidal solid in an ideal fluid has been shown to be chaotic (Aref, 1993) under the limit of non-integrability of Kirchhoff's equations (Kozlov & Oniscenko, 1982). On the other hand, the particle could stop moving when the damping viscous force is strong enough. We present numerical evidence using our in-house immersed solid solver for 3D chaotic motion of a general ellipsoidal solid and suggest criteria for triggering such motion. Our immersed solid solver functions under the framework of the Gerris flow package of Popinet et al. (2003). This solver, the Gerris Immersed Solid Solver (GISS), resolves 6 degree-of-freedom motion of immersed solids with arbitrary geometry and number. We validate our results against the solution of Kirchhoffs equations. The study also shows that the translational/ rotational energy ratio plays the key role on the motion pattern, while the particle geometry and density ratio between the solid and fluid also have some influence on the chaotic behaviour. Along with several other benchmark cases for viscous flows, we propose prediction of chaotic Aref's orbits as a key benchmark test case for immersed boundary/solid solvers.

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