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Inertial particle dynamics with history effects at fixed computational cost DIVYA JAGANATHAN, International Centre for Theoretical Sciences TIFR Bengaluru, S GANGA PRASATH, Harvard University, Cambridge MA, VISHAL VASAN, RAMA GOVINDARAJAN, International Centre for Theoretical Sciences TIFR Bengaluru — The unsteady dynamics of a small, spherical particle in a non-uniform flow is described by the Maxey-Riley (MR) equation. The Basset-Boussinesq term in the equation, which is an integral of the particles history weighted by time-dependent kernel, is known to impact transient dynamics but is often neglected or approximated due to its computational cost which grows linearly with the time of simulation. We address this by using an evolution equation for the history term due to Prasath et al.(2019). They showed that the MR equation with Basset-Boussinesq term can be posed as a Robin boundary condition to the 1D heat equation. This formulation and the closed-form expressions it affords, leads to a new time-iterative scheme to evaluate the full MR equation without approximation for generic nonlinear fluid flows. This method has a fixed computational cost per time-step and gives spectral accuracy, thus making it amenable to long-duration and multi-particle runs. We further reduce the cost associated with the iterative solver by employing only local velocity gradient information to compute the history effect. We present our numerical scheme to handle the evolution of a particle with history effects in 2D nonlinear flows.

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