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High Order Semi-Lagrangian Advection Scheme[1] CARLOS MALAGA, FRANCISCO MANDUJANO, Physics Department, School of Science, Universidad Nacional Autonoma de Mexico, JULIAN BECERRA, PETROSOFT, Mexico — In most fluid phenomena, advection plays an important roll. A numerical scheme capable of making quantitative predictions and simulations must compute correctly the advection terms appearing in the equations governing fluid flow. Here we present a high order forward semi-Lagrangian numerical scheme specifically tailored to compute material derivatives. The scheme relies on the geometrical interpretation of material derivatives to compute the time evolution of fields on grids that deform with the material fluid domain, an interpolating procedure of arbitrary order that preserves the moments of the interpolated distributions, and a nonlinear mapping strategy to perform interpolations between undeformed and deformed grids. Additionally, a discontinuity criterion was implemented to deal with discontinuous fields and shocks. Tests of pure advection, shock formation and nonlinear phenomena are presented to show performance and convergence of the scheme. The high computational cost is considerably reduced when implemented on massively parallel architectures found in graphic cards.

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