

Multilevel Monte Carlo Approximation of Statistical Solutions of Incompressible Flows

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”We present a finite difference-(Multi-level) Monte Carlo algorithm to efficiently compute statistical solutions of the two dimensional Navier-Stokes equations, with periodic boundary conditions and for arbitrarily high Reynolds number. We propose a reformulation of statistical solutions in the vorticity-stream function form. The vorticity-stream function formulation is discretized with a finite difference scheme. We obtain a convergence rate error estimate for this approximation. We also prove convergence and complexity estimates, for the (Multi-level) Monte Carlo finite-difference algorithm to compute statistical solutions. Numerical experiments illustrating the validity of our estimates are presented. They show that the Multi-level Monte Carlo algorithm significantly accelerates the computation of statistical solutions, even for very high Reynolds numbers.”