A MASSIVELY PARALLEL, VARIABLE TIME-STEP, MULTI-GPU SOLVER FOR THE INCOMPRESSIBLE NAVIER–STOKES EQUATIONS

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Abstract. In 2011, Guermond and Minev proposed a massively parallelizable directional splitting method for the time discretization of the incompressible Navier–Stokes equations [1]. In this talk, a modification to this method is proposed that can further take advantage of the high computational throughput afforded by graphics processing units (GPUs) as well as the efficiency of variable time steps, two features that the original method did not possess. It is shown that the performance of this modification compares well with that of the original method as well as one based on the fast Fourier transform when executed on a single GPU with constant time steps. However, the proposed method shows substantial performance gains over the original method when executed on multiple GPUs. The outperformance is further increased when using variable time steps.

Keywords: pseudo-compressibility method, domain decomposition, parallel algorithm

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References

[1] J. L. Guermond and P. D. Minev. A new class of massively parallel direction splitting for the incompressible Navier–Stokes equations. *Computer Methods in Applied Mechanics and Engineering*, 200(23–24):2083–2093, 2011.

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