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Incompact3d: a powerful tool to tackle turbulence problems with up to hundreds of thousands computational cores SYLVAIN LAIZET, Imperial College London, NING LI, NAG — Understanding the nature of complex turbulent flows remains one of the most challenging problems in classical physics. Significant progress has been made recently using High Performance Computing, and Computational Fluid Dynamics is now a credible alternative to experiments and theories in order to understand the rich physics of turbulence. In this work, we present an efficient numerical tool called "Incompact3d" that can be coupled with massive parallel platforms in order to simulate turbulence problems with as much complexity as possible, using up to hundreds of thousands computational cores by means of Direct Numerical Simulation. "Incompact3d," that solved the incompressible Navier-Stokes equation, is a finite-difference code (sixth order schemes in space) that can be combined with an Immersed Boundary Method (IBM) in order to simulate flow with complex geometry. The originality of this code is that the Poisson equation is solve in the spectral space in the framework of the modified wave number. We will demonstrate that "Incompact3d" is a powerful tool that can undertake DNS with up to hundreds of thousands computational cores thanks to an efficient 2D domain decomposition.

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