Homework assignment 9

October 28, 2019

To be handed in by 23:59 on Sunday November 3rd. For all your coding exercises, I recommend that you use a Jupyter notebook which you can later export as PDF.

1. Explain the different role of pressure in the incompressible and the compressible Euler/Navier-Stokes equation. Explain how this changes the locality/non-locality of the stencils.

2. Is the CFL stability condition the same for incompressible and compressible Navier-Stokes equations? Why (or why not)?

3. Explain the relationship between the artificial compressibility method and an iterative method for solving an elliptic equation. In your answer you should detail the analogy between pseudo-time and artificial compressibility.

4. Write down an equation to solve the incompressible Euler (no viscosity) equations in a 2D unit, periodic square, following the ideas outlined in Chapter 14.3. You should already have available most of the tools from previous homeworks, such as the Riemann solver, the reconstruction routines and the Poisson equation solver.

Use the initial conditions provided in 14.6.1, which have an analytical solution to compare your results to the analytical solution.