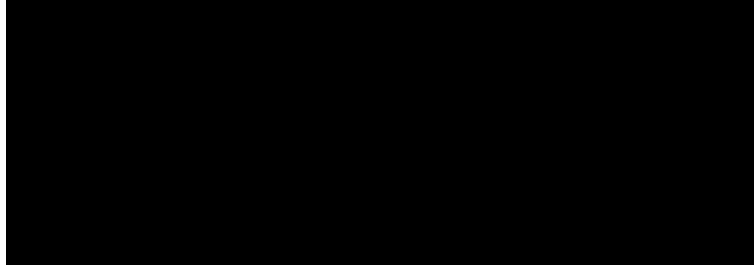


This numerical experiment was first presented in [?]. It consists of an isothermal Rayleigh-Taylor instability in a two-dimensional box of size $Lx = 0.9142$ and $Ly = 1$ (see Fig. ??).



Two Newtonian fluids are present in the system: the buoyant layer is placed at the bottom of the box and the interface between both fluids is given by

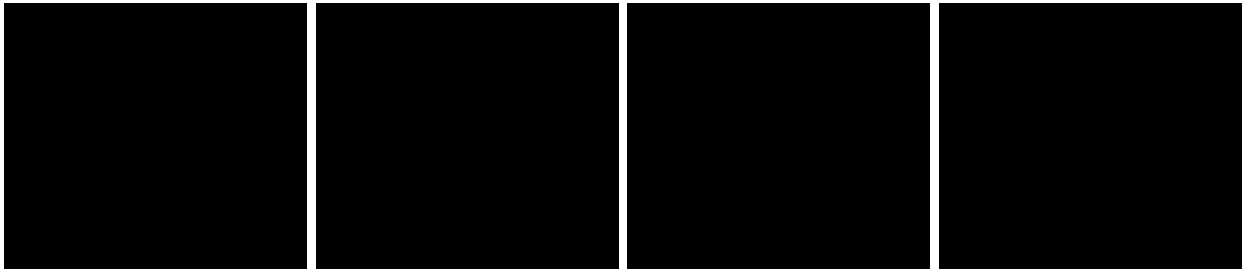
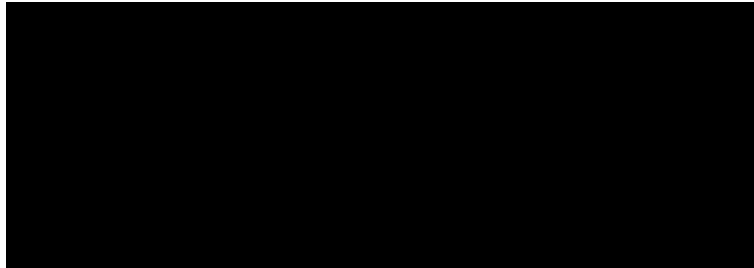
$$y(x) = 0.2 + 0.02 \cos\left(\frac{\pi x}{L_x}\right) \quad (1)$$

The bottom fluid is parametrised by its mass density ρ_1 and its viscosity μ_1 , while the layer above is parametrised by ρ_2 and μ_2 .

No-slip boundary conditions are applied at the bottom and at the top of the box while free-slip boundary conditions are applied on the sides.

In the original benchmark the system is run over 2000 units of dimensionless time and the timing and position of various upwellings/downwellings is monitored. In this present experiment only the root mean square velocity is measured at $t = 0$: the code is indeed not yet foreseen of any algorithm capable of tracking deformation.

Another approach than the ones presented in the extensive literature which showcases results of this benchmark is taken. The mesh is initially fitted to the fluids interface and the resolution is progressively increased. This results in the following figure:



features

- $Q_1 \times P_0$ element
- incompressible flow
- mixed formulation
- isothermal
- numerical benchmark