Study of an iterative mesh refinement algorithm for shear flows

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In this study we evaluate the influence of the mesh refinement algorithm on the flow properties and evolving Kelvin–Helmholtz instability.
The simulation was carried out using our own implementation of the CABARET computational method using a weak compressibility model.
The use of a shape function of the hyperbolic tangent type showed that mesh refinement is associated with the use of an integrated nonlinear transformation. The transformation of nested point multitudes is not one-to-one, that is, the same point occupies different places in different sets of grids, and also requires several iterations to condition the quality of the refinement. An iterative process produces a resulting set of meshes. Its points appear to be stationary for the integral transformation performed.
The analyzed parameters are the initial momentum thickness $\delta_{\theta,0}$, the initial vorticity thickness $\delta_{\omega,0}$, kinetic energy E, viscous dissipation rate ε_2, dilatation dissipation ε_3, as well as the growth rate γ. For the specific harmonics $n = 6$ with the highest growth rate, there are no artifacts detected (spurious vortices) for the vorticity field. Research has shown that coarse mesh refinement has a greater effect. The problem formulation, leading to the vortex sequence and its subsequent merger in a turbulent cascade, also enhances the convergence of viscous dissipation rate ε_2. The dissipation dilatation component ε_3 showed that its contribution to the total energy budget is small, that justifies weak compressibility model used.