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Modelization of the turbulent flows using turbulent vorticity

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The next expression, using Reynolds decomposition technique, shows the system of motion equations including the turbulent vorticity effect as a kind of forcing:

$$-\frac{\nabla \overline{P}}{\rho} = \nabla \left(\overline{E_c'} \right) + \nabla \overline{v} \cdot \overline{v} + \overline{\xi} \times \overline{v} + \overline{\xi' \times v'}$$

where $E_c^{'}$ is perturbed kinetic energy, $v$velocity, $v^{'}$ turbulent perturbation of velocity, ξ vorticity, $\xi^{'}$ perturbation of vorticity,P normal pressure and ρ density.

We have developed a numerical integration of the system. The model uses the finite difference method, both temporally and spatially centred. One of the applied meshes in the model splits the coordinates X, Y and Z in 82x82x110 grid (using a Pentium IV PC) and the numerical model has been solved with initial conditions corresponding to a motion with constant velocity on all grid points except the three dimensions centred one which has a different velocity, this fact involves the existence of no null vorticity.

We show as well some graphic results in which you can observe the evolution and develop of imposed velocity with the initial conditions. It is marked how from one unique vortex the model develops variegated vortices as the time.