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QUASI-HYDRODYNAMIC MODEL AND SMALL SCALE TURBULENCE

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ABSTRACT

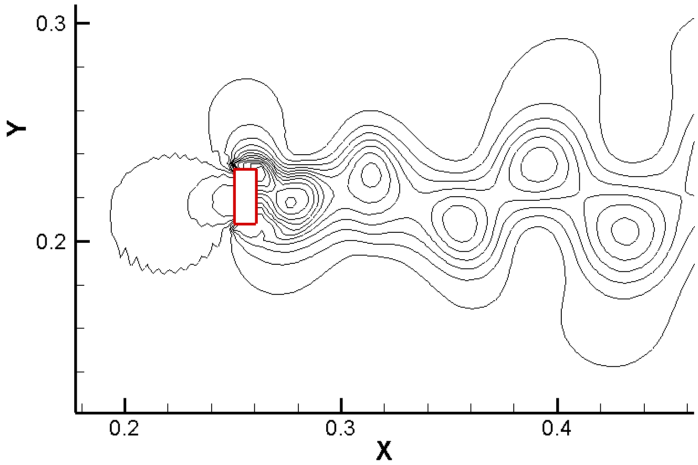
The averaged quasi-hydrodynamic(QHD) system of equations describing small-scale turbulence and its implementation is presented. The QHD equations differ from the Navier-Stokes ones by additional dissipative terms. For low and middle speed flows these terms are related to the molecular viscosity coefficient. For turbulent flows it is no longer related with molecular viscosity and must be adjusted to fit the general flow features. In this case QHD system simulates transfer of an average characteristics of a stream with movement of turbulent particles by analogy to molecular transfer. A turbulent small scale has been constructed by using $k-\varepsilon$ mathematical model for the turbulent kinetic energy.

To approve the model in case of plane geometry the problem of vortex shedding past rectangular cylinders with $Re=5\cdot 10^4$ has been considered. The conservative finite-difference schemes on Cartesian and triangular meshes and the algorithms of their numerical implementation has been developed.

The obtained results were compared with results of other authors and physical experiments. The comparative characteristic is an averaged drag coefficient. For example, table below represents a drag coefficient for rectangular cylinders with different ratios of their sides.

	dx/dy=0.2	*dx/dy*=0.4	*dx/dy*=0.6	*dx/dy*=0.8	*dx/dy*=1.0
experiment	1.98	2.15	2.94	2.43	2.1
Numerical simulation	1.86	1.98	3.23	2.24	2.15

where *dx* – length, *dy* – width of rectangular cylinder measured in number of finite volumes of Cartesian mesh, *dy*=10 is a constant value, main stream oriented perpendicular to *dy*. The figure bellow represents isolines of pressure distribution for *dx/dy*=0.4.



A precision of transient flows depends on mesh size therefore demands a significant computing resources. The general aspect of this paper is increasing of solution quality on less detailed meshes. This model was tested on a set of simple shapes, but these results can be very useful to predict behavior of more complicated objects.

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