DESIGNS OF SPATIAL TURBULENT FLOWS IN DEVICES OF INTRICATE FORM

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Thermal machines, such as turbines, pumps, compressors, so widely widespread in industry, that modern society will not be able to exist without them. The modern planning of economical thermal machines is based on implementation of both physical and calculable experiment which takes into account the features of viscid three-dimensional flow of liquid or gas. It allows already on the initial stages of planning to carry out the search of rational form of elements thermal machines without bringing in of physical experiment.

The system of equalizations, that allows to execute the calculations of parameters of stream, is folded:

from equalization of maintenance of impulse

$$\frac{\partial K}{\partial \tau} + \int_f \rho \cdot c_n \cdot \vec{c} \cdot df = \int_V \rho \cdot \vec{F} \cdot dV + \int_f \vec{p}_n \cdot df ,$$

equalization of maintenance of moment of impulse

$$\frac{\partial M}{\partial \tau} + \int_f \left[\vec{r} \times \vec{c}\right] \cdot \rho \cdot c_n \cdot df = \int_V \left[\vec{r} \times \vec{F}\right] \cdot \rho \cdot dV + \int_f \left[\vec{r} \times \vec{p}_n\right] \cdot df$$ equali

zation of conservation of energy

$$\frac{d}{d\tau} \int_V \rho \cdot \left(U + \frac{c^2}{2} \right) \cdot dV = \int_f \left[\vec{p}_n \cdot \vec{c}\right] \cdot df + \int_V \left[\vec{F} \cdot \vec{c}\right] \cdot \rho \cdot dV + \int_V \rho \cdot q \cdot dV$$

equalization of unbreak

$$\frac{\partial \rho}{\partial \tau} + div(\rho \cdot \vec{c}) = 0 ,$$

equalization of the state

$$\left(\frac{\partial v}{\partial T}\right)_p \cdot \left(\frac{\partial T}{\partial p}\right)_v \cdot \left(\frac{\partial p}{\partial v}\right)_T = -1 ,$$

equalization of process

$$\frac{dp}{p} + n \cdot \frac{dv}{v} = 0.$$

In general case such system of differential equalizations can not be decided even numeral.

There is a row of difficulties at the design of stream, which are related both to complication of physical processes which take a place in the probed vehicles and with the problems of adequacy of mathematical models. Calculations are executed with the use of the application programs, intended for the design of spatial turbulent flows in the devices of difficult form, for example, ANSYS/Flotran, Fluent, CFX-TASCflow, Flower but other

In these programs Nav'e –Stoks's equalization is decided numeral :

$$\frac{du_i}{d\tau} = \rho \cdot F_i - \frac{\partial p}{\partial x_i} + \frac{\partial}{\partial x_j}\left[\mu \cdot \left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i} - \frac{2}{3}\frac{\partial u_k}{\partial x_k}\delta_{ij}\right)\right],$$

where $\delta_{ij} = \begin{cases} 1 \text{ ï ðè } i = j \\ 0 \text{ ï ðè } i \neq j \end{cases}$.

Often averaged by Reynolds equalization of motion is decided:

$$\frac{\partial \overline{c_i}}{\partial \tau} + \overline{c}_j \cdot \frac{\partial \overline{c_i}}{\partial x_j} = \vec{F} - \frac{1}{\rho} \cdot \frac{\partial \overline{p}}{\partial x_i} + \frac{\partial}{\partial x_j}\left(\nu \cdot \frac{\partial \overline{c_i}}{\partial x_j} - \overline{c_i' c_j'}\right).$$

As a rule, programs of such complexes has a general kernel and can be divided into 4 groups :

1) the programs of preparations of geometrical and gas-dynamic basic data, workings in the conversational mode with visualization of geometry of running part;
2) programs of construction of calculation area: calculation of co-ordinates of knots and birth-certificate of net with visualization of net surfaces;
3) gas-dynamic programs: initial approaching and flowing around;
4) programs of visualization of results of gas-dynamic_calculations: construction of the graphs, isolines and vectors of streamline.

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