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Abstract—The main tool for the study of gas dynamics, heat and mass transfer of turbulent jet flows of multi component gas mixtures is mathematical modeling, which in contrast to the physical experiment is often more cost-effective and often the only possible method of research. In general, the simulation of turbulent jet flows of the reacting gas mixtures based on the common system of coupled partial differential equations that express the laws of conservation of mass, momentum, energy and mass.

Keywords—Turbulence models, arising nozzle, gas dynamics.

Introduction. In [1 ÷ 9] presents mainly the results of experimental and theoretical - numerical calculations devoted to research flow of air flowing from the nozzle of rectangular shape.

In this paper the method of calculation and some numerical results of the study of three-dimensional turbulent reacting gas jets emanating from the nozzle of rectangular shape.

Problem Statement. Consider reactive streams flowing from the nozzle of rectangular shape and extending wake (flooded) air flow. As the origin of the Cartesian system we choose the center of the initial section of the jet: the x-axis is directed along the jet and the axis OY and OZ parallel to the sides of the nozzle and the size respectively. Suppose that for symmetric about the axis OX and planes YOX, ZOX, which form the boundary of the domain of integration and that allow us to consider only one-quarter of the rectangular jet.

This flow is described by the following system of equations paralyzed [7 + 11]:

\[ \frac{\partial \rho u}{\partial x} + \frac{\partial \rho v}{\partial y} + \frac{\partial \rho w}{\partial z} = 0, \]  
\[ \rho u \frac{\partial u}{\partial x} + \rho v \frac{\partial u}{\partial y} + \rho w \frac{\partial u}{\partial z} = - \frac{\partial P}{\partial x} + \frac{\partial}{\partial y} (\mu_T \frac{\partial u}{\partial y}) + \frac{\partial}{\partial z} (\mu_T \frac{\partial u}{\partial z}), \]  
\[ \rho u \frac{\partial v}{\partial x} + \rho v \frac{\partial v}{\partial y} + \rho w \frac{\partial v}{\partial z} = \frac{\partial P}{\partial y} + 4 \frac{\partial}{\partial x} (\mu_T \frac{\partial v}{\partial x}) + \frac{\partial}{\partial z} (\mu_T \frac{\partial v}{\partial z}) - 3 \frac{\partial}{\partial y} (\mu_T \frac{\partial v}{\partial y}), \]  
\[ \rho u \frac{\partial w}{\partial x} + \rho v \frac{\partial w}{\partial y} + \rho w \frac{\partial w}{\partial z} = \frac{\partial P}{\partial z} + 4 \frac{\partial}{\partial x} (\mu_T \frac{\partial w}{\partial x}) + \frac{\partial}{\partial y} (\mu_T \frac{\partial w}{\partial y}) - 3 \frac{\partial}{\partial z} (\mu_T \frac{\partial w}{\partial z}), \]  
\[ \rho \frac{\partial H}{\partial x} + \rho \frac{\partial H}{\partial y} + \rho \frac{\partial H}{\partial z} = \frac{1}{Pr_T} \frac{\partial}{\partial y} (\mu_T \frac{\partial H}{\partial y}) + \frac{1}{Pr_T} \frac{\partial}{\partial z} (\mu_T \frac{\partial H}{\partial z}) + (1 - \frac{3}{Pr_T}) \frac{\partial}{\partial x} (\mu_T \frac{\partial u}{\partial x}) + \]  
\[ \frac{\partial}{\partial y} (\mu_T \frac{\partial v}{\partial y}) + \frac{\partial}{\partial z} (\mu_T \frac{\partial w}{\partial z}) + \frac{4}{3} \frac{\partial}{\partial y} (\mu_T \frac{\partial v}{\partial y}) + \frac{\partial}{\partial z} (\mu_T \frac{\partial w}{\partial z}) \]  
\[ \frac{\partial C_i}{\partial x} + \rho \frac{\partial C_i}{\partial y} + \rho \frac{\partial C_i}{\partial z} = \frac{1}{Sc_T} \frac{\partial}{\partial y} (\mu_T \frac{\partial C_i}{\partial y}) + \frac{1}{Sc_T} \frac{\partial}{\partial z} (\mu_T \frac{\partial C_i}{\partial z}) + W_i, \]  
\[ \frac{\partial k}{\partial x} + \rho \frac{\partial k}{\partial y} + \rho \frac{\partial k}{\partial z} = \frac{\partial}{\partial y} (\frac{\mu_T}{\sigma_k} \frac{\partial k}{\partial y}) + \frac{\partial}{\partial z} (\frac{\mu_T}{\sigma_k} \frac{\partial k}{\partial z}) + G - p \varepsilon, \]  
\[ \frac{\partial \varepsilon}{\partial x} + \rho \frac{\partial \varepsilon}{\partial y} + \rho \frac{\partial \varepsilon}{\partial z} = \frac{\partial}{\partial y} (\frac{\mu_T}{\sigma_\varepsilon} \frac{\partial \varepsilon}{\partial y}) + \frac{\partial}{\partial z} (\frac{\mu_T}{\sigma_\varepsilon} \frac{\partial \varepsilon}{\partial z}) + C_{\varepsilon 1} G - C_{\varepsilon 2} \rho \varepsilon \frac{\varepsilon}{k}, \]


