SIMULATION OF NONSTATIONARY FLOWS IN MULTICOMPONENT MEDIA BASED ON A THERMOMECHANICAL EQUILIBRIUM MODEL IMPLEMENTED IN THE SINARA CODE PACKAGE

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The paper discusses one of the approaches used in the hydrodynamics calculation of flows in multicomponent media. In these calculations the interfaces between materials may become unstable in the sense of Rayleigh-Taylor, Richtmyer-Meshkov or Kelvin-Helmholtz and collapse thus forming the zones of turbulence.

The turbulence zones are described with diffusive mixing models implemented in the 2D SINARA code. In these zones, materials are mixed and the properties of each mixture component need to be taken into account in hydrodynamics calculations.

Two approaches can be used to solve hydrodynamics equations in multicomponent flow simulation. The first uses a model of partial components where all materials in the mixture have average characteristics, average density and temperature in the (ρ, T) variables, and pressure is determined by averaging the pressures of mixed materials with respect to their mass concentrations,

$$P = \sum_k c_k P_k(\rho, T).$$

The second determines the average parameters of the medium with use of individual thermodynamic characteristics $(\rho_k, \varepsilon_k, T_k)$ for mixed materials and some closing relations.

The model of partial components was used in SINARA calculations with diffusive mixing models. This work considers the implementation of the second approach based on individual thermodynamic characteristics. The paper presents a new implicit difference scheme for solving multicomponent hydrodynamics with a thermomechanical equilibrium model that assumes pressures and temperatures to be identical for all materials in a cell, i. e., $T = T_1 = T_2 = \ldots = T_K$, $P = P_1(\rho_1, T) = P_2(\rho_2, T) = \ldots = P_K(\rho_K, T)$. Test calculations were performed for a model problem to compare results obtained with the partial component model and the presented model based on the individual thermodynamic characteristics.