NUMERICAL SIMULATION OF SHOCK WAVE INTERACTION WITH TURBULIZED MEDIUM

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The shock tube experiments performed by Nevmerzhitsky et al. [1] were simulated using the direct numerical simulation method. Two shock waves generated in this tube one after another at a certain time interval move successively through three regions filled with air, helium, or SF6. When the first shock wave passes through the air-helium and helium-SF6 interfaces, the Richtmyer-Meshkov instability occurs at these interfaces, which leads to a contact gas mixing. When the second shock wave goes through these mixing zones, the wave front undergoes deformation and spreading due to density fluctuations, so the front loses its planeness and begins to expand. The specific features of shock wave passing from heavy gas to light one (i.e., air-to-helium travel) and vice versa (i. e., helium-to-SF6 travel) are studied.

Random interface perturbations approximating the disruptions of gas-separating films were set in the simulations. The EGAK computations were carried out using the 2D and 3D simulation approach. These predictions were compared to the experimental data on the development of turbulent mixing zones and the deformation of shock wave when it travels through the turbulent region and afterwards.

Direct simulations were supplemented by simulations using the k-ε turbulence model. These predictions agree with both the direct simulation results and the experimental data.

References

1. **Nevmerzhitsky, N. V.** Experimental data on shock-wave interaction with turbulent mixing zone [Text] / N. V. Nevmerzhitsky, E. D. Senkovsky, E. A. Sotskov et al. // International conference "Zababakhin Scientific Talks". – 2025.