

Software package for calculating two-dimensional flows in Lagrangian coordinates

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Research in the field of continuum mechanics is based on the use of various software packages now. Commercial programs allow solving a wide range of applied problems, but the existing physical and mathematical models are constantly being supplemented and complicated, which makes it impossible to quickly improve the modeling tools. On the other hand, the development of our own software systems mostly solves the above-described disadvantages. The creation of a software product that allows solving computational fluid dynamics problems with an architecture that allows you to quickly modify the source code for solving specific problems is an urgent task. In this work, an algorithm for calculating two-dimensional flows in Lagrangian coordinates is numerically implemented, based on the Kuropatenko method [1,2], the use of which to determine auxiliary quantities on the faces of grid cells allows, on the one hand, to correctly describe the energy dissipation at the shock front, and with on the other hand, to preserve entropy on smooth flows. Reconstruction of the Lagrangian grid is based on the method [3], and consists in recalculating all parameters from the old grid to the new one in accordance with the laws of conservation of mass, momentum and energy. The developed software package has shown its efficiency when testing on problems with an analytical solution.

[1] Kuropatenko V F 1960 *Doklady AN SSSR* **133** 771–772

[2] Kuropatenko V F and Shestakovskaya E S 2017 *Osnovy mekhaniki sploshnykh sred* (Chelyabinsk: SUSU)

[3] Yalovets A P 1997 *J. Appl. Mech. Tech. Phys.* **38** 137–150