Spreading of flame front I by the predictor-corrector scheme

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Abstract: In this paper, we present the algorithm for the numerical solution of non-stationary equations describing the process of distribution of a flame in a two-fuel mixture. For the numerical simulations of the process of flame spreading is desired to use moving irregular meshes which are thickened to a region of high gradients of temperature and concentration of the mixture, since the calculations for such grids can have a high precision even with a small amount of nodes [1].

The proposed finite-difference scheme "predictor-corrector" in step "predictor" splitting method is used with the explicit approximation of the convective terms in the first step and an implicit fractional approximation of diffusive members on the second fractional step. This second step involves the fractional member responsible for the burning process. In addition, in step "predictor" of explicit scheme determined by the flow at the edges of cells. We have proposed a method of selecting grid parameters allowing to calculate profiles of numerical solutions without spurious oscillations.

The proposed method of adapting the grid to a moving flame front tested on scalar nonlinear convection-diffusion equation with a nonlinear right-hand side, as well as a model system of two nonlinear equations. For meshing we used equivalence distribution method that focuses on the use of time-dependent problems. We have shown that the use of adaptive grids allows to obtain a numerical solution with the same precision as in a uniform grid, but with the number of nodes on the order of less.

Keywords: Predictor-corrector, computational modeling, flame front, flame spreading, flame spreading, algorithm of calculation

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References

[1] Varnets, Y., Maas, U., Dibbl, R. Gorenie, "Physical and chemical aspects, modeling, experiments, formation of polluting sub-stances", .: Phizmatlit, 2003.