Numerical Calculation Method for 2D Equation of Heat Conductivity for Multi-Component Environment in the EGAK Code

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In this paper we propose two approaches to the solution of the problem of improvement of approximation accuracy of the equation of heat conductivity in the vicinity of multi-channel cells used in the EGAK code.

The first approach is based on the using of adaptive-embedded refined computational grids in the vicinity of the interfaces. The 1st-level refined grid is obtained by fragmentation of the primary grid cell - "mother cell" – into four fragments by the lines which connect the centers of its edges; the 2nd-level grid is obtained by the fragmentation of the 1st-level cells, etc. The features of the approximation of the equation of heat conductivity on the refined grid are discussed in the report; the calculation results for some test problems are presented.

The essence of the second approach is in the using of mixed cells of the specific model of multi-component heat conductivity, which does not imply the equity of the components, but is based on the fact that in the mixed cells heat exchange between the components takes place according to the same heat conductivity laws as those for the mean energy in regular heat conductivity. The main idea consists in the splitting of the heat conductivity process into tow scales; to separately take into account these two scales the splitting principle by physical processes is used. The "big scale" – heat exchange between the cells – is taken into account in a regular implicit difference scheme, where the mean parameters of the mixed cells are calculated with some sound method. After that heat exchange works on the "small scale" – heat exchange between the components inside the mixed cells; as the input data it uses the heat flows through the cell interfaces calculated at the first stage. At the second stage of the program these flows are divided between the components; the problem of distribution of the energy increment due to the heat conductivity between the components of the mixed cells is solved independently in each mixed cell. The results of the test and method-based calculations are given in the report. A considerably higher accuracy of the proposed method as compared to the method that employs the supposition of the components' temperature equity in the mixed cells, is shown.