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HYBRID NUMERICAL METHOD FOR NON-STATIONARY CONTINUUM MECHANICS

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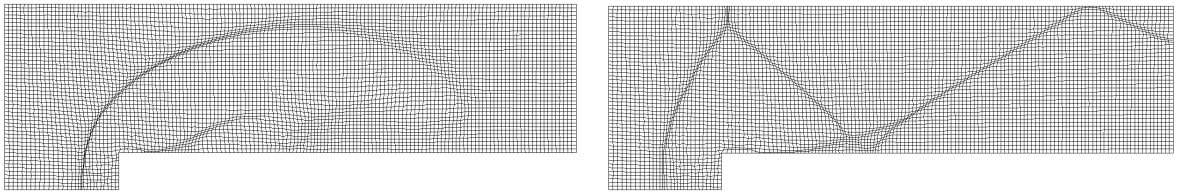
In the basement of used hybrid method for calculation of flows of the continuous media lays the modified SUPG FEM scheme on arvitrary moving adaptive grids. The calculation is carried out in areas of variable geometry on the main grid covering with a stock the solution area. The main grid is arbitrary moving and adaptive to the solution. The purpose of the grid nodes motion is minimization of approximation errors near jumps and in interfaces that is realized approximately by means of the elastic grid method [1]. Mobility of the main grid nodes is limited to the requirement of cell convexity.

For the description of complex variable geometry of solution region the additional overlapping grids are applied in order to exclude from calculation the nodes and cells of the main grid covered with the overlapping grids in the zones inaccessible to continuum media flows. The variational formulation allows easy implementation of boundary conditions on borders of the overlapping grids.

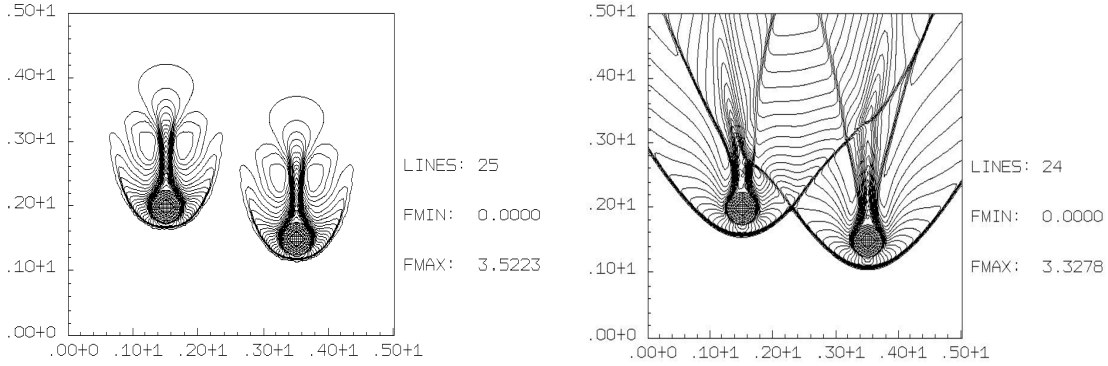
Typical examples of calculations of non-stationary flows of continuous media by means of the moving adaptive and overlapping grids are presented in Fig. 1, a-b.



а) M=3; γ=1.4; t = 0.5 б) M=3; γ=1.4; t = 4.0

Рис.1. Well known test for unsteady ideal gas flow in channel with a step, adaptive grid behavior.

Calculation results for problem of ideal gas flow about two obstacles (Fig. 2, a-b) and for solid mechanics problem of turbine blade formation are also presented. Merits of the hybrid method of the adaptive overlapping grids are simplicity of implementation and use. The work is supported by Russian Foundation for Basic Research project No. 15-08-02392.



а) t=0.45 б) t=7.0

Fig.2. Isolines of local Mach number.

References

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