ABOUT ONE OPPORTUNITY OF RECONSTRUCTION FIELDS OF SPEEDS, PRESSURE AND VORTICITY BY RESULTS OF INTERFERENCE MEASUREMENTS

O. S. Ilyina, S. V. Ilyin

[1]*Chuvash State University ,428015, Cheboksary, Moskovsky pr. 15, Russia*

Interferometric techniques are frequently used in combustion research. They are widely employed in the visualization and qualitative analyses of burning processes, in flame geometry measurements, In calculating density and temperature fields,.in the present study one more, unconventional, application area of interferometric techniques will be discussed, the determination of velocity, pressure and vortex fields in non-stationary flows of combustion products with certain additional related issues taken to be covered.

When studying the gas dynamics of combustion processes one generally has to deal with objects wherein a gas movement arises and develops in such a manner that at least the front portion of the flow is contained within a bounded region of space. This situation is characteristic of the initial stage of ignition and explosion, the interaction of a directional gas flow and obstacles, processes inside a combustion chamber, problems in internal ballistics. In [1] it is demonstrated that for such gas flows (for convenience, later referred to as bounded non-stationary flows) it is possible to determine the mechanical impulse of a flow segment, isolated from the entire flow by two arbitrary parallel planes, as well as the force acting upon it from the time history of interference patterns. The subsequent development of the above techniques showed that they permit a tomographic problem of the reconstruction of scalar potential density of mechanical impulse for bounded non-stationary flows to be formulated [2]. In the same place it is shown that by tomographics methods in potential approximation it is possible to reconstruct fields of speeds and pressure.

In the given work the further development of these ideas is considered. If to take advantage of the vector equation of movement with the help of some transformation of him it is possible to present as the sum of two vector fields. One of them will be only potential, and another - vortical. The potential component includes members connected with pressure, a derivative on time from potential of density of mechanical impulse of a flow and some integrated member dependent in the nonlinear image from local distribution of speeds and density in researched stream. For a vortical component it is possible to show that she will depend on a derivative on time from vector potential of density of mechanical impulse of a flow and some vector integrated expression as dependent on local distribution of speeds and density in a researched flow. The obtained vector equation at enough common assumptions can be divided. Then one equation will connect value of pressure in a stream to scalar potential of density of mechanical impulse of a flow and distribution of speed, and another a derivative on time from vector potential of density of mechanical impulse of a flow. This system of the equations can be solved by an iterative process, with zero approximation to the appropriate experimentally certain scalar potential of density of mechanical impulse. In this paper the given problem is considered and analyzed. On the elementary objects opportunities of the given procedure are investigated.

The research described in this paper has been supported by the Russian Foundation for Basic Research (Project No. 03-01-00823a and 05-03-32900a).

References

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