The process of enhancement of air-hydrogen mixture combustion in the channel using an air jet

© V.P. Zamuraev[1,2], A.P. Kalinina [1,2]

[1]Khristianovich Institute of Theoretical and Applied Mechanics,
Siberian branch of RAS, Novosibirsk, 630090, Russia
[2]Novosibirsk State University, Novosibirsk, 630090, Russia

The purpose of the study was to carry out the numerical simulation of the launch of a ramjet using the method without significant loss of total pressure. The method was proposed by the group headed by P.K. Tretyakov. It provides a transition to the transonic condition in the combustion chamber using a jet with a distributed fuel supply along the chamber length. The presence of a jet of compressed air, which creates the throttle effect, is crucial as well as a preliminary flow deceleration to transonic speeds is. In this work, CFD calculations were performed to simulate the flow deceleration to transonic speeds within the framework of the hypothesis of low values of turbulent kinetic energy. The averaged Navier – Stokes equations closed by the k—ω SST turbulence model were solved. The combustion of hydrogen was simulated by a single reaction. A pulsating mode was obtained: heat generation during the combustion of hydrogen increases the pressure and blocks its inflow, then the area of increased pressure is carried downstream, a new portion of hydrogen flows in, the process of ignition is in progress, and so on. The critical role in the ignition of hydrogen is played by the shock wave caused by the air stream. Combustion occurs in the zones of separation, vortex zones, the boundary layer. Thus, for the channels under consideration, the possibility of decelerating the flow in a channel with Mach number M = 2 to transonic speeds is numerically shown, which is a favorable prerequisite for implementing combustion in the expanding part of the channel.

Keywords: *supersonic flow, Navier – Stokes equations, transonic condition, transverse jets, hydrogen combustion*

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Zamuraev V.P., Cand. Sc. (Phys.-Math.), Assoc. Professor, Senior Researcher, Khristianovich Institute of Theoretical and Applied Mechanics, Siberian branch of RAS. Author of over 70 publications in the field of aerodynamics, in particular, pulse-periodic control of supersonic and transonic flows. e-mail: zamuraev@itam.nsc.ru

Kalinina A.P., Dr. Sc. (Phys.-Math.), Senior Researcher, Assoc. Professor, Senior Researcher, Khristianovich Institute of Theoretical and Applied Mechanics, Siberian branch of RAS. Author of over 70 publications in the field of aerodynamics, in particular, pulse-periodic control of supersonic and transonic flows. e-mail: kalinina@itam.nsc.ru