CONTROLLED REFLECTION OF COMPRESSION WAVES GENERATED BY PULSATING COMBUSTION AS A WAY TO INCREASE THRUST OF EJECTOR PULSEJET ENGINE WITH A DOUBLE BEND GAS DUCT

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Abstract: The formation of compression waves during cyclic pulsating combustion is the process that fundamentally distinguishes it from the stationary combustion. The paper considers the interaction of compression waves with the walls of the gas duct of a pulsejet engine having a double bend when deflagration combustion is realized. The computational model is based on the replacement of pulsating combustion by pulsating heat input. The experimental results showing the importance of taking into account the motion of compression waves are also given. The results obtained allow one to develop new design solutions for gas ducts of pulsejet engines realizing the potential of compression waves for the sake of achieving higher specific characteristics.

Keywords: ejector pulsejet engine; compression wave; engine gas duct; deflagration combustion

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Figure Captions

Figure 1 Fragment of the pressure distribution inside the gas duct of an ejector pulsejet engine during the operating cycle at a velocity of the approaching flow of 60 m/s and a pulsation frequency of 100 Hz: *1* — front end wall; *2* — canopy; *3* — rear end wall of the combustion chamber; and *4* — diffuser

Figure 2 Fragment of pressure distribution inside the engine gas duct

Figure 3 Motion of the reflected compression wave at the blowdown stroke of engines with normal (*a*) and inclined (*b*) end walls. The angle of inclination of the end wall is 20°

Figure 4 Distribution of thrust during the operating cycle by elements of the engine gas duct structure with normal front and rear end walls (*a*) and with the end wall inclined by 20° (*b*): *1* — total thrust; *2* — front wall; *3* — rear wall; *4* — visor; and *5* — diffuser

Figure 5 Engine with honeycomb insert. Dimensions are in millimeters

Figure 6 Pressure records of the operating process at an incoming air flow velocity of 60 m/s: (*a*) ejector pulsejet engine with the axial vortex valve; and (*b*) the same but with honeycomb insert instead of the axial vortex valve

Figure 7 Schematic of the engine with ribs and inclined walls. Dimensions are in millimeters

Figure 8 Visualization of the mechanism of influence of the inclined wall and transverse ribs on the thrust from pressure forces

Figure 9 Amplitudes of thrust force and fuel consumption pulsations for three types of engines at air velocities of 67 and 125 m/s

Figure 10 Change in the character of the operating process of engine type No. 2 when changing the air velocity: (*a*) 67 m/s; and (*b*) 125 m/s

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