

ON THE TYPES OF COMBUSTION PROCESS IN AN EJECTOR DOUBLE-DUCT PULSEJET ENGINE

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Abstract: The experiments have shown that in an ejector pulsejet engine, along with deflagration combustion, other types of combustion can be observed which are characterized by high amplitudes of pressure pulsations in the combustion chamber. This article evaluates the possibility of achieving high pulsation amplitudes when implementing such types of combustion as spherical detonation, volumetric self-ignition, and avalanche activation of combustion. The numerical solution is based on replacing the combustion process with cyclic heat deposition.

Keywords: valveless ejector double-duct pulsejet engine; deflagration combustion; spherical detonation; avalanche activation of combustion

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Figure Captions

Figure 1 Pressure pulsation in the combustion chamber: (a) deflagration combustion, free-flow speed 60 m/s; (b) cyclic detonation of a fuel-lean mixture; and (c) cyclic detonation of a fuel-rich mixture, free-flow speed 120 m/s

Figure 2 Cyclic heat deposition zone

Figure 3 Predicted jet thrust pulsation forms due to pressure forces: (a) $K = 0.25$; and (b) $K = 0.05$. The grey line shows the average value of jet thrust from the action of pressure forces for a half of the engine

Figure 4 Predicted effect of heat deposition duration on jet thrust from the momentum of the jets (1) and pressure forces (2), maximum pressure in the combustion chamber (3), and average air flow through the engine (4)

Figure 5 Calculated forms of pressure pulsations in the combustion chamber in the case of volumetric self-ignition (a) and during cyclic spherical detonation (b) with a frequency of 50 Hz at a blowing speed of 100 m/s

Figure 6 Predicted stage-by-stage development of spherical detonation in the gas duct of an ejector pulsejet engine

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