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SIMULATION OF A DETONATION COMBUSTION CHAMBER

Abstract

Using detonation combustion mode in small scale engines increases their thermodynamic efficiency. Detonation waves are supersonic pressure driven combustion waves, across which thermodynamic parameters change significantly. The sharp overpressures behind the detonation wave make this process attractive for the development of thermally efficient propulsion systems. The Continuous Rotating Detonation Engine represents an innovative propulsion system centered around detonation combustion. It boasts several notable advantages, including a straightforward design, high specific impulse, compact dimensions, and a substantial heat release rate. In this paper, a three-dimensional numerical simulation of a continuous detonation wave engine is carried out. The mathematical model is based on the multicomponent gas dynamics considering chemical transformations and turbulent transport. The comparison of the effect of braking pressure on the characteristics of the combustion chamber is considered. Oxygen is considered as an oxidizer, hydrogen or acetylene as fuels. The obtained results are compared with experimental data. The development of the mathematical models and numerical simulations were performed using the facilities of National Research Centre "Kurchatov Institute" Federal Science Centre "Scientific Research Institute for System Analysis of the Russian Academy of Sciences", Russia and supported by the subsidy No. 1021061509701-5-1.2.1 (FNEF-2022-0021)