Numerical simulation of a detonation engine

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Three-dimensional numerical modeling of a rotating detonation engine (RDE) combustion chamber is performed based on the original code. The RDE is a new type of engines capable to create higher thrust than the traditional ones based on the combustible mixture deflagration process. This type of an engine has more efficient thermal dynamics [1]. The combustion chamber under consideration is a co-axial hollow cylinder. The fuel is injected from one side, either premixed with the oxidizer, or from separate injectors. It is ignited in the chamber near the injectors, and this invokes the self-sustaining detonation wave which is then rotates consuming the combustible mixture. The burnt gases are expanded in the central part of the chamber where the internal hollow body changes from cylinder to cone and then vanishes. After the expansion, they leave the chamber from the side opposite to the injectors. The primary ignition is modeled by an energy source strong enough to produce an instant detonation wave. The calculations are based on the Navier–Stokes system of equations along with the equations for turbulence modeling and the chemical kinetics [2]. This work was supported by the subsidy of the Ministry of Science and Education of Russian Federation on the topic "Investigation and development of detonation combustion chambers being used in perspective aerospace propulsion systems" (No. 075-15-2021-1385).

[1] Wolanski P 2013 *Proc. Combust. Inst.* **34** 125–158
[2] Mikhalchenko E V, Nikitin V F, Phylippov Y G and Stamov L I 2021 *Shock Waves* **31** 763–776