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INCREASING THE EFFICIENCY OF COMBINED CONTROL OF THE ROCKET ENGINE THRUST VECTOR

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Solving new problems of rocket space stage control calls for improving rocked engine thrust vector control actuators in order to reduce energy consumption for control, simplify their design, and improve their dynamic performance and reliability.

As a result of previous studies, in which the authors of this work took part, a new bifunctional thrust vector control system based on a combination of a mechanical and a gas-dynamic thrust vector control system was proposed and substantiated. That solution on thrust vector control improvement made it possible to realize the advantages of the constituent subsystems, while eliminating their disadvantages.

This paper focuses on the drawback of the new concept of thrust vector control, which consists in the need for heavy-mass drives to rotate engine components.

The paper presents and substantiates a new solution on eliminating the above drawback by transferring the function of the rotary drives to the gas-dynamic system.

In doing so, the large force that rotates the engine on the hinge is produced by the gas-dynamic system in a pulsed mode, thus eliminating large energy consumption (during the operation of the gas-dynamic system) for engine rotation. The rocket stage is stabilized by control forces of small amplitude and high frequency produced by the gas-dynamic control system. So the bifunctional thrust vector control system is transformed into a system that is entirely gas-dynamic, except that a hinge joint is used to rotate engine components (in the case under study, the combustion chamber). The elimination of drives reduces the mass of the thrust vector control system, increases its reliability, and allows one to carry out its complete dynamic testing under terrestrial conditions because there is no need to rotate the engine during its operational development. The thrust vector control energy consumption (engine specific impulse loss) of the proposed system does not exceed that of an economy mechanical system (where the trust vector is controlled by engine rotation)..

Keywords: *rocket engine; mechanical system; impulse force; gas-dynamic system; bifunctional thrust vector control system.*

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