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Increasing the efficiency of an interceptor system for rocket engine thrust vector control

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This work is concerned with studying the static and dynamic characteristics of the gas-dynamic (interceptor) subsystem of a combined system for thrust vector control and identifying ways to increase its efficiency. The combined control system includes a mechanical and a gas-dynamic subsystem. The gas-dynamic thrust vector control subsystem is the most important and reliable part of the combined control system.

Consideration is given to disturbing the supersonic flow by installing a solid obstacle (interceptor) in the middle part of the rocket engine nozzle. An important advantage of this method to gas-dynamically control the rocket engine thrust vector is that the thrust vector control loss of the specific impulse is nearly absent because the control force is produced without any consumption of the working medium. Injection through the interceptor protects it against exposure to the nozzle supersonic flow and produces an additional lateral force.

By now, the optimum height of the mass supply opening in the interceptor that maximizes the control force has not been determined, and the dynamic characteristics of this system have not been studied.

The aim of this work is to find the optimum position of the opening for working medium supply through the interceptor that maximizes the added control force and to determine the effect of the transfer functions of the interceptor system components on the characteristics of the control force production transient.

As a result of the study of the static characteristics of the supersonic flow disturbance in a nozzle with an interceptor through which a secondary working medium is injected, it is concluded that in terms of thrust vector control efficiency and interceptor protection the injection opening should be situated in the upper part of the interceptor.

The transfer function of interceptor control of the liquid-propellant rocket engine thrust vector is obtained with account for the production of an additional control force by the injection of a liquid propellant component. It is found that the loss of stability of the operation of an injection interceptor unit depends on the transient of the working medium injection control valve.

Keywords: *rocket engine, thrust vector control system, static and dynamic characteristics, gas-dynamic system, combined control system.*

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