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# Computing control action parameters for gas jet injection into the expansion section of a nozzle

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*The study deals with methods of computing control force during rocket engine thrust vectoring by asymmetrically injecting gas into the expansion section of a supersonic nozzle. This technique has a number of advantages, so there exists an interest in the methods that make it possible to reliably estimate the efficiency of using this technique for thrust vectoring, to select geometric and mode parameters in advance and through this, to cut down considerably on the volume of expensive experimental development testing. We compared the results of calculations that used a semi-empirical method and the results of a 3-dimensional computation to experimental data. We studied how the way of supplying the injected gas affects the control force amplitude and the thrust loss through vectoring. For designing power plants that comprise a supersonic controller nozzle, it is possible to use the control action calculation methods considered and the data obtained.*

**Keywords:** rocket engine, control action, injection, mathematical modelling

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