Aerodynamic Design of Axisymmetric Supersonic Nozzle Used by an Optimization Algorithm

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Abstract : In this paper, it has been studied the method of optimal design of the supersonic nozzle. It could make viscous axisymmetric nozzles that the quality of their outlet flow is quite desired. In this method, it is optimized the divergent nozzle, at first. The initial divergent nozzle contour is designed through the method of characteristics and adding a suitable boundary layer to the inviscid contour. After that, it is made a proper grid and then simulated flow by the numerical solution and AUSM+ method by using the operation boundary condition. At the end, solution outputs are investigated and optimized. The numerical method has been validated with experimental results. Also, in order to evaluate the effectiveness of the present method, the nozzles compared with the previous studies. The comparisons show that the nozzles obtained through this method are sufficiently better in some conditions, such as the flow uniformity, size of the boundary layer, and obtained an axial length of the nozzle. Designing the convergent nozzle part affects by flow uniformity through changing its axial length and input diameter. The results show that increasing the length of the convergent part improves the output flow uniformity.