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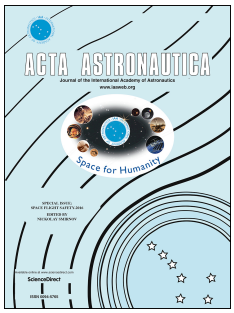

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Wei Huang, Lang-quan Li, Li Yan, Tian-tian Zhang

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Drag and heat flux reduction mechanism of blunted cone with aerodisks

Wei Huang*, Lang-quan Li, Li Yan, Tian-tian Zhang

Science and Technology on Scramjet Laboratory, National University of Defense Technology, Changsha, Hunan 410073, People's Republic of China

Abstract: The major challenge among a number of design requirements for hypersonic vehicles is the reduction of drag and aerodynamic heating. Of all these techniques of drag and heat flux reduction, application of forward facing aerospike conceived in 1950s is an effective and simpler technique to reduce the drag as well as the heat transfer rate for blunt nosed bodies at hypersonic Mach numbers. In this paper, the flow fields around a blunt cone with and without aerodisk flying at hypersonic Mach numbers are computed numerically, and the numerical simulations are conducted by specifying the freestream velocity, static pressure and static temperatures at the inlet of the computational domain with a three-dimensional, steady, Reynolds-averaged Navier-Stokes equation. An aerodisk is attached to the tip of the rod to reduce the drag and heat flux further. The influences of the length of rod and the diameter of aerodisk on the drag and heat flux reduction mechanism are analyzed comprehensively, and eight configurations are taken into consideration in the current study. The obtained results show that for all aerodisks, the reduction in drag of the blunt body is proportional to the extent of the recirculation dead air region. For long rods, the aerodisk is found not that beneficial in reducing the drag, and an aerodisk is more effective than an aerospike. The spike produces a region of recirculation separated flow that shields the blunt-nosed body from the incoming flow, and the recirculation region is formed around the root of the spike up to the reattachment point of the flow at the shoulder of the blunt body. The dynamic pressure in the recirculation area is highly reduced and thus leads to the decrease in drag and heat load on the surface of the

Associate Professor, Corresponding author, E-mail: gladrain2001@163.com, Phone: +86 731 84576447, Fax: +86 731 84512301