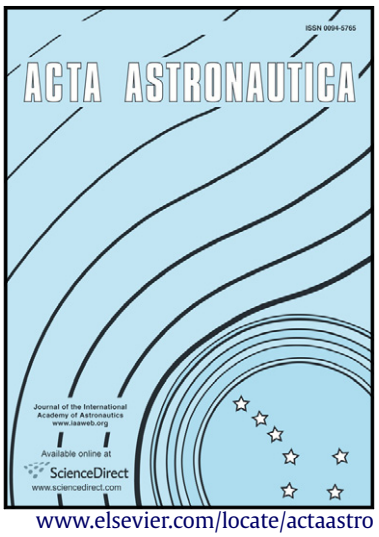

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Wei Huang, Jun Liu, Zhi-xun Xia

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Drag reduction mechanism induced by a combinational opposing jet and spike concept in supersonic flows

Wei Huang*, Jun Liu, Zhi-xun Xia

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

Abstract: The drag force of hypersonic vehicles and missiles makes a great difference to their final performance and hence to their design process. A drag reduction strategy has been proposed and investigated numerically in the current study, namely the combinational opposing jet and aerospike concept, and the influences of length-to-diameter ratio of aerospike and jet pressure ratio on the drag reduction mechanism have been evaluated. The predicted results have been compared with the available experimental data in order to validate the numerical approach, and the grid independency analysis has been conducted as well. The obtained results show that the numerical results show good agreement with the ground experimental data, and the grid scale has only a slight impact on the numerical results. The drag reduction coefficient increases with the increase of the length-to-diameter ratio of aerospike and the jet pressure ratio, and the maximum drag reduction coefficient deceases with the increase of the jet pressure ratio. The maximum drag reduction coefficient is 65.02%, and it occurs when the jet pressure ratio is 0.4. The peak pressure location moves nearly from 40º to 55º, and it is nearly the same irrespective of the variation of the jet pressure ratio.

Keywords: Hypersonic vehicle; drag reduction; opposing jet; spike; supersonic flow

1. Introduction

The drag force of hypersonic vehicles and missiles has a great impact on their final performance and hence on

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