

Drag Reduction of Base Bleed at Various Flight Conditions

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Abstract : This study focus on the drag reduction effect of the base bleed at supersonic flow. Base bleed is the method which bleeds the gas on the tail of the flight vehicle and reduces the base drag, which occupies over 50% of the total drag in any flight speed. Thus base bleed can reduce the total drag significantly, and enhance the total flight range. Drag reduction ratio of the base bleed is strongly related to the mass flow rate of the bleeding gas. Thus selecting appropriate mass flow rate is important. However, since the flight vehicle has various flight speed, same mass flow rate of the base bleed can have different drag reduction effect during the flight. Thus, this study investigates the effect of the drag reduction depending on the flight speed by numerical analysis using STAR-CCM+. The analysis model is 155mm diameter projectile with boat-tailed shape base. Angle of the boat-tail is chosen previously for minimum drag coefficient. Numerical analysis is conducted for Mach 2 and Mach 3, with various mass flow rate, or the injection parameter I , of the bleeding gas and the temperature of the bleeding gas, is fixed to 300K. The results showed that $I=0.025$ has the minimum drag at Mach 2, and $I=0.014$ has the minimum drag at Mach 3. Thus as the Mach number is higher, the lower mass flow rate of the base bleed has more effect on drag reduction.

Keywords : base bleed, supersonic, drag reduction, recirculation

Conference Title : ICAIAE 2017 : International Conference on Aerospace Infrastructure and Aerospace Engineering

Conference Location : London, United Kingdom

Conference Dates : May 25-26, 2017