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钝化前缘乘波布局及其一体化构型气动特性

Aerodynamic characteristics of waverider and its integrated configuration with blunt leading edge

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中文摘要:

以最大升阻比为优化目标,在锥型流场中优化设计出乘波布局,并考虑高超声速飞行器的防热需求,对乘波布局进行钝化设计,利用数值模拟和风洞实验两种手段,研究钝化前缘乘波布局的气动特性.结果表明:在一定钝化半径内,随着钝化半径的增加,乘波构型的升力特性变化仅为2%,但阻力特性增加近3倍,升阻比降低了将近50%.尽管如此,为了钝化乘波布局,仍维持了较高的升阻比,升阻比为3左右.同时,以二维顶压式进气道为基础,在多级楔锥组合体流场中,设计出满足超燃发动机进气要求的乘波前体/进气道一体化构型,并进行前缘钝化设计.针对一体化构型进行了数值验证,结果表明:此类一体化构型升阻比大于2.6,同时发动机总压恢系复数保持在40%左右,满足进气道的要求.

英文摘要:

The maximum lift-drag ratio was used as the optimization target,and a waverider configuration from the conical flow field was designed.To meet the needs of heat protection,a waverider configuration with blunt leading edge was designed.Numerical and experimental methods were used to analyze the aerodynamic characteristics of blunt waverider configurations.The results show that with the blunt radio increasing, the lift of blunt waverider increases 2% and the drag of blunt waverider is nearly 3 times larger than that of the sharp waverider, as well as the ratio of lift to drag of blunt waverider is 50% of that of the sharp waverider. For blunting waverider configurations, the high lift-drag radio characteristics is kept both on and off design conditions.The 2-D inlet was used as the basis,and a waverider/inlet integrated configuration from the muti-wedge-cone flow field was designed.Blunt-leading design was conducted for the integrated configuration.The results from the numerical analysis show that the ratio of lift to drag of this configuration is greater than 2.6, and the total pressure recovery of the inlet is almost 40%, which can meet the requirements of inlet.