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基于壁面马赫数梯度的高超声速弯曲激波二维进气道数值研究

Computational investigation of hypersonic curved shock two-dimensional inlet with compression surface constant Mach number gradient

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中文关键词： 超燃冲压发动机进气道 二维高超声速进气道 Ma 线性分布规律 弯曲激波 数值仿真

英文关键词:scramjet inlet two-dimensional hypersonic inlet Mach number linear distribution curved shock numerical simulation

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中文摘要：

研究了一种壁面马赫数(Ma)呈线性分布规律的曲面压缩面,以此设计了高超声速弯曲激波二维进气道,并与同等条件下常规三楔压缩二维进气道进行了比较.数值研究结果表明:根据给定的壁面 Ma 线性分布规律和压缩面增压比,通过有旋特征线理论来设计压缩面的方法是可行的;与常规三楔压缩相比,此方法能改善压缩面附面层的稳定性,能有效缩短外压缩段的长度,并且其性能参数对来流 Ma 变化影响不敏感,特别是非设计状态下性能优势尤为突出.在接力点 Ma 下其流量系数达到0.783,比常规三楔压缩二维进气道提高13.2%,同时喉道截面总压恢复系数也提高4.5%.

英文摘要：

A type of curved compression surface with wall Mach number linear distribution was investigated,and a hypersonic curved shock two-dimensional inlet was designed.The performance was compared with normal three-ramp compression inlet designed under the same conditions.The result shows that:curved compression surface can be designed through rational characteristic linear theory according to the given wall Mach number linear distribution and pressure ratio.Compared with normal three-ramp compression,the new inlet has more stable boundary layer and much shorter external compression surface,but not very sensitive to the change of free stream Mach number.Especially,the inlet has an excellent performance under off-design conditions.The mass flow rate reaches 0.783 at relay point Mach number and is increased by 13.2% compared to normal three-ramp compression two-dimensional inlet, while the total pressure recovery of throat section is also increased by 4.5%.

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