

论文

带展向曲率的超音速混合层中扰动演化的研究

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摘要 超音速混合层的流动不稳定性较之亚音速或不可压的混合层大大减弱, 为了提高混合效率, 通过数值模拟的方法分别研究了展向曲率、展向速度、来流马赫数等因素对混合效率所起的作用. 计算结果表明: 在给定展向速度的情况下, 带有展向曲率的三维混合层, 曲率越大三维扰动增长率越大, 而且法向的卷起范围也越大. 当展向曲率不为零时, 展向速度的增大也能有效地增强混合能力. 由流场中的高频扰动波产生的涡, 在向下游发展过程中会有破碎、拉伸, 低频扰动波没有发现这一现象. 对于有展向曲率和展向速度的混合层, 提高来流马赫数时, 流场中最不稳定扰动的增长率仍很大. 因此, 这是一种提高混合层混合效率的新途径.

关键词 [三维超音速混合层](#) [增强混合](#) [展向曲率](#) [展向速度](#) [扰动演化](#)

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A study on disturbances evolution in supersonic mixing layer with spanwise curvature

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Abstract

In order to enhance the mixing efficiency, the effects of spanwise curvature, spanwise velocity and Mach number are studied by the method of DNS. When the spanwise velocity is fixed, the larger the spanwise curvature, the larger growth rate of the 3-D disturbances will be for the 3-D compressible mixing layer with the spanwise curvature. The increase of spanwise velocity can also enhance the ability of blending when the spanwise curvature is not zero. The spanwise vorticity produced by high frequency disturbance wave will break down and stretch in the course of evolution but this phenomenon is not found in the low frequency disturbance cases. With a high Mach number, the most instable disturbance still has a large growth rate for the mixing with spanwise curvature and velocity. Therefore, it is an effective method for enhancing the mixing.

Key words [3-D supersonic mixing layer](#) [mixing enhancement](#) [spanwise curvature](#) [spanwise velocity](#) [the evolution of disturbances](#)

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