

论文

应用PIV对角区非定常马蹄涡结构的实验研究

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收稿日期 2007-5-22 修回日期 网络版发布日期 2008-3-20 接受日期

摘要 利用PIV技术研究了柱体与平板层流边界层角区的非定常流动结构, 流动显示和PIV测量均表明角区存在3种非定常的马蹄涡模式, 即绕合模式、脱落-绕合模式以及脱落-耗散模式, 一定 Re 数下主涡脱落后既可能表现为脱落-绕合模式, 也可能表现为脱落-耗散模式. 这主要取决于模型头部形状对涡轴造成的拉伸以及耗散和扩散程度. PIV测量表明, 随雷诺数增加主涡下方从壁面喷发的反向二次涡逐步增大形成强度和尺度较大的“涡舌”, 该“涡舌”将突入整个涡系所在的边界层, 最终将主涡与上游涡系隔离并使其从旋涡生成区涡系脱落. 马蹄涡非定常摆动时具有较复杂的奇点形态组合和演化, 反映涡轴受到了交替的拉伸和压缩作用.

关键词 [角区流动](#) [三维分离](#) [非定常流动](#) [马蹄涡](#) [PIV](#)

分类号 [0357](#)

The experimental study on unsteady horseshoe vortex structure in juncture flow with PIV

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Abstract

The PIV technique was utilized to study the characteristics of laminar unsteady horseshoe vortex in juncture flow. The visualization and the PIV show that there are three unsteady modes: amalgamating, shedding off-amalgamating and shedding off-dissipating. At a certain Reynolds number the shedding off vortex can be presented as shedding off-amalgamating or shedding off-dissipating, which depend on the leading edge shape of modals, for it changes the stretch of the vortices so that it influence the dissipation and diffusion of the corner vortex. The PIV show that secondary vortex forms a growing negative vorticity tongue, which may eventually penetrate into the boundary layer and effectively isolates the primary vortex from the impinging B.L., allowing the primary vortex to shed off. In unsteady oscillation mode, the vortex singular points show rather complex structure combination, which indicate the alternating stretch and compression of the vortices.

Key words [juncture flow](#) [3-D Separation](#) [unsteady flow](#) [horseshoe vortex](#) [PIV](#)

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