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可压缩非平行流边界层稳定性研究

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STUDY OF COMPRESSIBLE NONPARALLEL FLOW STABILITY FOR BOUNDARY LAYERS

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摘要

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摘要 采用线性稳定性理论和多重尺度方法,研究三维可压缩的非平行流边界层稳定性问题。分析了可解条件的特征,导出精确计算所需的伴随问题方程渐近外边界条件的矩阵表达式,给出有控制的重正化方法,以有效地克服刚性方程在积分求解中的困难。探讨与非平行性作用相关的方程和影响因素,特别是新的特征函数畸变对扰动增加率的作用。通过算例,清楚地显示了流动的非平行性对边界层稳定性的影响。

关键词: 非平行流 边界层稳定性 三维 可压缩流 多重尺度法

Abstract: WT5°BZ]The compressible linear stability theory and the method of multiple scales are used to study the problem of three dimensional nonparallel flow stability for boundary layers. Solvability condition is analyzed. A matrix expression of the asymptotic edge boundary condition, which is used to exact numerical computation, is derived. A controlled renormalization method is used, in order to resolve the difficulty due to the stiff feature of these equations. The related equations and elements to nonparallelism are studied, including specifically the effect of new distortion of the eigenfunction on the disturbance growth rate which is important for boundary layer stability. The examples presented clearly show the effect of nonparallel flow on boundary layer stability.

Keywords: nonparallel-flow boundary layer stability three dimensions compressible flow multiple scales method

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