Public Abstract

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Title:Saddle point of attachment in horseshoe vortex system

Laminar juncture flow has been well studied experimentally and numerically in recent years. New topology upstream in terms of saddle point of attachment has been investigated by both approaches. In this work, the obstacle standing on the flat plate was replaced with a jet flow. Numerical simulation and theoretical analysis were performed to investigate the upstream topology. The numerical results were validated with the mathematical theory and topology rules. The upstream critical point satisfies the condition of occurrence for saddle point of attachment in the horseshoe vortex system. In addition to the classical topology led by the saddle point of separation, the new topology led by saddle point of attachment was discussed for the first time in a crossflow with jet. The transition of critical point from separation to attachment is determined by the jet to crossflow velocity ratio, boundary-layer thickness of flat plate, and the oscillation of the jet. With decreasing the velocity ratio, the flow topology changes from new topology to the classic topology when the boundary layer thickness at the upstream edge of the jet is about 0.2 diameter. But if boundary layer thickness is close to one diameter the variation of the velocity ratio has no effect on the topology while changing the location of the saddle point. The transition of the critical point from separation to attachment was also observed with the increasing boundary layer thickness. Under the influence of jet oscillation, the characteristics of the critical point could change between separation and attachment in a higher frequency.