

Near Critical Unsteady Three-Dimensional Triple Deck Flows

Stefan Braun, Alfred Kluwick

Institute of Fluid Mechanics and Heat Transfer, TU Vienna, Vienna, Austria

In a number of cases interactive solutions for steady two-dimensional laminar triple deck boundary layer flows are known to exist up to a critical value α_c of a controlling parameter α (e.g. ramp angle of subsonic corner flows) only. In the present paper we investigate three-dimensional unsteady perturbations of such boundary layers assuming that the basic flow is almost critical, i.e. in the limit $\alpha - \alpha_c \rightarrow 0$. It is then shown that the interactive equations governing such perturbations simplify significantly allowing, among others, a systematic study of blow-up phenomena as observed also in related investigations of marginally separated boundary layers. Specifically it is found that solutions leading to the formation of finite time singularities can be continued beyond the blow-up time thereby generating moving singularities which can be interpreted as vortical structures quite similar to those emerging in direct numerical simulations and experimental observations of transitional separation bubbles.

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