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The stability of buoyancy-driven gaseous boundary layers over inclined semi-infinite hot plates PRABAKARAN RAJAMANICKAM, WILFRIED COENEN, ANTONIO L SANCHEZ, University of California San Diego — The free-convective boundary-layer flow that develops over a semi-infinite inclined hot plate is known to become unstable at a finite distance from the leading edge, characterized by a critical value of the Grashof number Gr_δ based on the local boundary-layer thickness δ. The character of the instability depends on the inclination angle ϕ, measured from the vertical direction. For values of ϕ below a critical value ϕ_c the instability is characterized by the appearance of spanwise vortices, whereas for $\phi > \phi_c$ the bifurcated flow displays Görtler-like streamwise vortices. The Boussinesq approximation, employed in previous linear stability analyses, ceases to be valid for gaseous flow when the wall-to-ambient temperature ratio $\theta_w = T_w/T_\infty$ is not close to unity. The corresponding non-Boussinesq analysis is presented here, accounting also for the variation with temperature of the different transport properties. The base-flow profiles are used in a parallel-flow temporal stability analysis to delineate the dependence of the critical Grashof numbers Gr_δ on the inclination angles ϕ and on the temperature ratio θ_w. The analysis provides in particular the values of the crossover inclination angles $\phi_c(\theta_w)$.

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