CONVECTIVE AND ABSOLUTE
INSTABILITIES IN THE INCOMPRESSIBLE
BOUNDARY LAYER ON A ROTATING-DISK

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Abstract

The linear absolute/convective instability mechanisms of the incompressible Von Karman's boundary layer flow over a rotating-disk are revisited in the present paper in order to review and assemble the available results in the literature on the topic. For this purpose the linearized system of stability equations of motion is first treated numerically, by employing a Spectral method based on Chebyshev collocation as well as a fourth-order Runge-Kutta method in combination with a shooting strategy. Inviscid/viscous stationary and travelling modes which lead to both convective and absolute instability mechanisms were successfully reproduced and compare favorably with those obtained by previous investigators. The validation of the zero-frequency upper-branch modes was also accomplished by the asymptotic expansion technique of [17], which is later extended to cover the non-zero frequency disturbances. The importance of the present study lies in understanding the roles of possible instability mechanisms on the laminar-turbulent transition phenomenon in the three-dimensional boundary layer flow over a rotating-disk, as well as related aerodynamic bodies.

Keywords: Rotating-Disk Flow, Absolute Versus Convective Instability, Matched Asymptotic Expansion, Laminar-Turbulent Transition.

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