ABSTRACT

Linear stability theory is applied to the flow arising from the surface of an isothermal vertical cylinder immersed in a fluid. A method is developed for solving the resulting coupled Orr-Sommerfeld type equations. Neutral stability curves are obtained for Prandtl numbers of .733, 5.9 and 100. The results are compared with the stability characteristics of flow over a vertical isothermal plate to observe the effect of the transverse curvature. It is shown that the plate and cylinder flow stability characteristics are similar in many respects and that as the ratio of the boundary layer thickness to radius tends to zero the cylinder flow results approach those for the flat plate. Transverse curvature results in a slight increase of the minimum critical Grashof number. An important finding of this study is that the most amplified frequencies are independent of the transverse curvature.

The experimental base flow field and velocity disturbance profiles at neutral stability show good agreement with theory. Experimental temperature disturbance profiles for amplified frequencies are also presented. Experimental evidence is provided to show that low frequency disturbances, which become unstable first, amplify

at a slower rate than high frequency disturbances which become unstable later. There exists a range of frequencies in which ripples appear in the positive part of the temperature disturbances. These ripples are thought to be characteristic of a band of amplified frequencies.